UNIVERSITY OF ALBERTA

THE EXAMINATION OF THE EFFECTS OF LONG DURATION, ACUTE EXERCISE ON ATTITUDES, SELF-EFFICACY, AND OUTCOME EXPECTATIONS IN OVERWEIGHT WOMEN

BY

LANA ASUCHAK ©

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfilment of the requirements for the degree of MASTER OF ARTS.

FACULTY OF PHYSICAL EDUCATION AND RECREATION

EDMONTON, ALBERTA

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Lana Asuchak

Lana Asuchak
#212 – 11218 – 80 Street
Edmonton, Alberta, Canada
T5B 4V9

Dated: Jan. 31/01

University of Alberta

Faculty of Graduate Studies and Research

The undersigned certify that they have read and recommended to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled **The examination of the effects of long duration, acute exercise on attitudes, self-efficacy, and outcome expectations in overweight women** submitted by **Lana Asuchak** in partial fulfilment of the requirements for the degree of **Master of Arts in Exercise Psychology.**

W Rodgers
Dr. Wendy Rodgers

Dr. Vicki Harber

R Plotnikoff
Dr. Ron Plotnikoff

L McCargar
Dr. Linda McCargar

Dated: Jan. 31/01

Abstract

Attitudes, self-efficacy, and outcome expectations have been utilized to study exercise behaviour. The current study examines these psychological variables over four days in conjunction with a physiological study of fixed energy expenditure and varying energy intake. Participants were comprised of 20 healthy, overweight women.

Results showed non-significant findings for attitudes, however overweight women displayed positive attitudes with respect to exercise. There was a group main effect for scheduling efficacy for the EA25 group and several day and day by group effects for outcome expectations. For outcomes, however, post hoc tests revealed non-significant findings. With the exception of scheduling efficacy, non-significant findings for understanding intense exercise behaviour in overweight women were found. However, sample size may not have allowed the statistical power to identify significant differences. Strengths, limitations, implications both theoretical and practical and future directions based upon the results of this study are provided.

ACKNOWLEDGMENTS

This thesis was completed with the assistance of many individuals to whom I am very grateful.

I would like to thank the 20 women who participated in my study for the sake of learning and research. I am very appreciative of the time devoted to my study.

I would like to extend thanks to my supervisor Dr. Wendy Rodgers and co-supervisor Dr. Vicki Harber for their advice and help throughout this long process.

I would also like to extend thanks to my other committee members Dr. Ron Plotnikoff and Dr. Linda McCargar for taking the time to read my thesis and being apart of my defense.

When my research became very difficult to manage on my own with working full-time, several fellow graduate students stepped in to help me out. Thanks to Kelly Mackenzie, Kerry McGannon, and Chris Blanchard for donating their time! I really appreciated it.

Thanks also goes to several lab assistants who also worked with me: Jennifer Humphreys and Christine Clarke.

What would I have done without the continued support from my dear friend Jennifer Crosby, whose words of advice and encouragement helped me to finish and move through the difficult times.

Thanks goes to Chris Blanchard and Carol Hills for helping me with my statistics, figuring out what to do, how to do it and understand it all. Also to my fellow fitness colleagues and friends Carol Hills, Kerry McGannon, and Kelly Mackenzie, thanks for listening to me, helping me with my thesis, and most of all, for motivating me.

Also a huge thank you to my parents for their love, encouragement and support throughout my many years of schooling. I am finally done, for awhile, anyways.

Thanks Geert Albert for motivating me during the final stages of my thesis. Coming into my life when you did gave me the drive and motivation to push forward and finish my thesis.

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LIST OF ABBREVIATIONS

ACSM	American College of Sports Medicine
ANOVA	Analysis of Variance
BMI	Body Mass Index
CHO	Carbohydrates
EA	Energy Availability
FFM	Fat Free Mass
FM	Fat Mass
g/day	Grams per day
GSA	Graduate Students Association
HR	Heart Rate
HR_{max}	Heart Rate Maximum
kcal/day	Kilocalories per day
kcal/kgFFM/day	Kilocalories per kilogram fat free mass per day
kcal/kgLBM/day	Kilocalories per kilogram lean body mass per day
kp	Kiloponts
L/min	Litres per minute
ml/kg/min	Millilitres per kilogram per minute
OD	Outcome Desirability
OE	Outcome Expectations
OL	Outcome Likelihood
PAR-Q	Physical Activity Readiness Questionnaire
Pro	Protein

RER	Respiratory Exchange Ratio
rpm	Revolutions per minute
SD	Standard Deviation
T_3	Triidothyronine
VO_{2max}	Maximal ventilatory oxygen consumption
VT	Ventilatory Threshold

CHAPTER 1

INTRODUCTION

Rationale for the Study

Physical activity is an important component of a healthy lifestyle, exerting positive influences on health and longevity. Regular physical activity provides a broad manifold of physiological and psychological benefits. Physiological benefits include improved blood pressure, body composition, bone density, immune function, insulin sensitivity, and lipid profiles. Therefore, physical activity is an effective adjuvant for the treatment of hypertension, obesity, osteoporosis and depression (Dishman & Buckworth, 1996; U.S. Department of Health and Human Services, 1996). Exercise has also been shown to reduce the incidence of colon cancer, cardiovascular disease and adult onset diabetes which account for one third of deaths attributable to sedentary behaviour (Pate et al, 1995; Powell & Blair, 1994; U.S. Department of Health and Human Services, 1996). Psychological benefits accruing from an active lifestyle include reductions in anxiety, depression, and stress and increases in vigour, clear thinking and self-concepts such as self-esteem, self-efficacy, and self-image (Cramer, Nieman, & Lee, 1991; Gauvin, Rejeski, & Norris, 1996: U.S. Department of Health and Human Services, 1996). Physical activity improves physiological and psychological status thereby reducing the incidence of disease and improving quality of life (U.S. Department of Health and Human Services, 1996).

Much research has been done to document the fact that being overfat poses a serious risk to one's health (Brodie, 1988; U.S. Department of Health and Human Services, 1996). Excess fat has been associated with hypertension, diabetes, orthopaedic complications such as degeneration of the weight bearing joints of the legs and vertebral column and muscular disabilities especially of the lower back (Brodie, 1988). Because a significant portion of the population is overfat and fairly inactive, it is important that we find out what will lead to exercise adoption, as these people have the most to gain in disease prevention and health promotion through even modest increases in activity levels (King, 1994). In a Canadian Heart Health Survey of close to 20,000 people, 29% of women in Canada were considered overweight with a body mass index (BMI) greater than or equal to 27 (National Institute of Nutrition, 1995). Proper nutritional habits combined with active living through a regular exercise program are ways to reduce the risks associated with being overweight.

According to Pinto, Marcus and Clark (1996), the numerous benefits of physical activity on morbidity and mortality for men have been well documented. Unfortunately, the advantages for women have not been as well examined, with most research conducted in men or mixed samples. Although, in recent years there has been more experiments conducted with women (Cramer et al, 1991; Gauvin et al, 1996; Nies, Vollman, & Cook, 1998). Participation by women in physical activity has important implications for their overall well being. Exercise ameliorates the incidence of heart disease in men; however, cardiovascular disease is as prevalent in postmenopausal women as in men of the same age (Nies et al, 1998). Also, regular physical activity may safeguard against osteoporosis, a leading cause of disability in older women. Reducing disability may lower the number of females who later in life live in nursing homes or residences for the elderly instead of their own abode (Nies et al, 1998). Many women discontinue participation in vigorous activity or sport after high school, therefore, remaining on the average, more sedentary than their male counterparts. As a result, women constitute a large high-risk group for degenerative, chronic diseases, related to sedentary behaviour that can compromise one's well being.

According to Pinto et al, these gender differences in exercise research may be the result of the lack of experiments involving female participants or secondary to the definition of exercise utilized by researchers and gender differences in the frequency of moderate versus vigorous physical activity. Marcus, Pinto, Simkin, Audrain, and Taylor (1994) also concur with Pinto et al that women as a group, have been an understudied population. The definition and operationalization of exercise poses a difficulty in the existing literature (Courneya & McAuley, 1994; McAuley, 1991; McAuley & Jacobson, 1991). Bouchard, Shephard, & Stephens (1994) identified the need for more research for determining types of exercise, intensity (how hard?), duration (how long?), and frequency (how often?) of exercise that will maximize the likelihood of its adoption and maintenance. However, there is no consistency in much of the physical activity research. Various forms of physical activity were measured, whether it was vigorous (Sallis, Hovell, & Hofstetter, 1992), moderate (McAuley, Bane, and Mihalko, 1995), an aerobic exercise intervention (McAuley, Courneya, Rudolph, and Cox, 1994) or on predicting strength training (Rodgers & Brawley, 1996). Some research has been conducted using the old guidelines for exercise set forth by the American College of Sports Medicine (ACSM) (McAuley, 1992). However these guidelines were based on exercise and fitness benefits and not the health benefits that can be realized through moderate forms of physical activity. Therefore, individuals who perceived themselves as incompetent to exercise at a prescribed intensity would slowly lose interest in exercising (McAuley & Jacobson, 1991).

Research has identified that physical activity is associated with gender, intensity, education, age, and income. Men, younger individuals, people with higher education and socio-economic status tend to be more active compared to women, older individuals, and people with lower education and socio-economic status. As well, men and younger people will engage in more vigorous forms of activity over women and older adults (Dishman, 1994; Sallis et al, 1992).

Past evidence in the physical activity domain suggested the adoption and maintenance of vigorous exercise as outlined by the ACSM. Because of the growing number of scientific studies demonstrating decreased morbidity resulting from increased moderate amounts of physical activity, the Centers for Disease Control and Health in conjunction with the ACSM released the publication of *Physical Activity and Health, A Report of the Surgeon General.* This document is the accumulation of all the research conducted on physical activity and exercise in the last forty years. It emphasizes moderate levels of physical activity to promote healthier lifestyles. Specifically, it recommends that every adult should accumulate 30 minutes or more of moderate intensity physical activity on most, preferably all days of the week (Pate et al, 1995). This can be achieved either through one bout of physical activity or through short bouts of activity interspersed throughout the day with an intensity corresponding to a brisk walk. Since the original position statement in 1978, the distinction has been made between physical activity as it relates to health versus fitness (Pollock et al, 1998). The quantity and quality of exercise differs depending on what the goal is. The new guidelines therefore, supplement the old guidelines, providing new options to get more of the population active. The traditional exercise-fitness model was expanded to include a broader physical activity-health paradigm. Significant health benefits can be obtained when going from a sedentary, inactive lifestyle to a minimum level of physical activity. Higher intensities or greater frequencies and durations would provide additional fitness benefits.

Despite the potential health benefits of participation in physical activity, the majority of women continue to be inactive or are active below optimal levels (Pinto et al, 1996). Problems of adherence to an exercise program are also widespread with studies typically showing an attrition rate of 50% six months following program commencement (Dishman, 1991). Barriers to physical activity in women include time constraints, inconvenient exercise facility, the costs of exercise, family obligations, young children, lack of knowledge, lack of role models, lack of social support, lack of physician guidance, and chronic health problems (Nies et al, 1998; Pinto et al, 1996). Thus, interventions need to be designed to help females overcome the obstacles preventing them from becoming more active. With health benefits gained through moderate activity, this has important implications for women as they are more likely to adopt this form of activity (Pinto et al, 1996).

The current investigation involved a long bout of exercise over three days at an intensity that was within the current ACSM guidelines. The duration, however, was very long. Thus, if duration and fatigue were associated with short and long term psychological outcomes, the present protocol would reveal them. It was hoped that with the completion of this study, the participants would feel like they had accomplished a great achievement. This may act as a confidence booster convincing them that they may be able to regulate their lifestyles to incorporate moderate amounts of activity into their daily lives to meet the guidelines of the Surgeon General's report. Applying the results of this study to the overweight, female population with the help of fitness and health professionals, the end product could be a better quality of life with reduced morbidity and mortality and lowered medical costs. The proposed research presents an opportunity to gather information on the psychological effects of acute exercise for an increased understanding of overweight individuals. Although in this study the exercise is time consuming for the purpose of understanding thyroid metabolism, exercise itself does not have to be of such a long duration to reap health benefits. To the author's knowledge, there has not been any research that has incorporated the physiological variables of exercise influenced by EA in conjunction with the psychological impact this may have on overweight women.

Different theoretical frameworks and constructs have been used to understand the psychological influences on physical activity. Physical activity is a complex, dynamic behaviour influenced by a myriad of factors both individual and environmental. Attitudes toward exercise, self-efficacy, and outcome expectations at varying time points may provide useful information in explaining physical activity patterns in overweight women.

Overview of Attitudes Toward Exercise, Self-Efficacy, and Outcome Expectations

There is a growing body of literature on attitudes, self-efficacy, and outcome expectations with regards to physical activity (Ajzen & Timko, 1986; Ducharme & Brawley, 1995; Fontiane & Shaw, 1995; McAuley, 1992; McAuley et al, 1995;

McAuley, Courneya, & Lettunich, 1991; McAuley et al, 1994; McAuley & Jacobson, 1992; McAuley, Wraith, & Duncan, 1991; Rodgers & Brawley, 1991; Rodgers & Brawley, 1996; Rodgers & Gauvin, 1998; Rodgers & Sullivan, in press; Wilcox & Storandt, 1996). A total of 14 articles focusing on primarily women were reviewed and will be discussed in greater detail in the review of literature.

Attitude

Attitude encompasses the favourable or unfavourable predisposition toward a specific behaviour (Fishbein & Ajzen, 1975). Attitude towards behaviour is a function of an individual's beliefs about the outcomes (behavioural beliefs) weighted by the evaluations of those outcomes. Attitude can then be indirectly measured and quantified. This is expressed in the algebraic equation $A = \sum (b \cdot e)$ which states that the sum of the products of beliefs (b) regarding the behavioural outcomes and the evaluations (e) of the outcomes will give an indirect measure of attitude (Blue, 1995). In the conceptual framework provided by Fishbein and Ajzen (1975), when beliefs about an object are formed, an attitude toward that object is automatically and simultaneously acquired. Each belief links the object to some attribute and the attitude toward the object is a function of one's evaluations of these attributes. Triandis (1971) remarks that attitudes involve what people think, feel, and how they will behave toward an object. Behaviour is determined by what people would like to do as well as by social norms, habits and by the expected outcomes of the behaviour.

There is a strong correlation between attitudes and the behaviour in question when they correspond with each other (Ajzen & Timko, 1986). Therefore, when measuring physical activity, a high correspondence will be achieved when specific measures of attitude are used. Attitudes have an affective and evaluative component (Ajzen & Timko, 1986). Evaluative attitudes relate to the advantages or disadvantages of the behaviour and affective attitudes associated with the behaviour can be positive or negative.

To gain a better understanding of attitude and exercise, it has been incorporated into the theory of planned behaviour (TPB). However, in this study, attitude was taken as a construct on its own for the purpose of describing attitudes in overweight women. This was in conjunction with examining self-efficacy and outcome expectations.

Self-Efficacy

Self-efficacy has been identified as one of the possible determinants of exercise behaviour (Ducharme & Brawley, 1995; Fontaine & Shaw, 1995; McAuley, 1992; McAuley et al 1995; McAuley, Courneya, et al, 1991, McAuley et al, 1994; McAuley & Jacobson, 1992; McAuley, Wraith, et al, 1991; Rodgers & Brawley, 1991; Rodgers & Brawley, 1996; Rodgers & Gauvin, 1998; Rodgers & Sullivan, in press). Coming from social cognitive theory, it is an approach to understanding human cognition, action, motivation and emotion that assumes people are capable of self-reflection and self-regulation and that they actively shape their environments rather than reacting passively to them (Maddux, 1995). According to Bandura (1997) self-efficacy beliefs play a central role in human agency guiding peoples' lives.

Self-efficacy theory distinguishes between self-efficacy and outcome expectations (Godin, 1994). Outcome expectations are described in detail later. Perceived self-efficacy refers to the convictions people have of their capabilities to organize and execute courses of action required to produce the outcomes (Bandura, 1977; 1986; 1997). It is not concerned with the skills one has, but with the judgment of what one can do with these skills under a variety of circumstances (McAuley, 1992). Therefore, different people with similar skills, or the same person under different circumstances, may perform poorly, adequately, or extraordinarily (Bandura, 1977). With self-efficacy theory, attempts to increase exercise behaviour would be influenced by judgement of the expected benefits of regular exercise and perceived ability to exercise regularly (Godin, 1994). Given appropriate skills and adequate incentives, self-efficacy is theorized to influence the activities that individual's choose to engage in, the effort expended on that particular activity and the degree of persistence demonstrated when confronted with barriers or obstacles (Bandura, 1977). People may have the skills and high self-efficacy for executing the skills, but choose not to perform the activity because they are lacking incentives or the necessary equipment or resources for adequately performing the behaviour. According to Bandura (1997), self-efficacy beliefs are not simply inert predictors of future performance. People contribute to, rather than merely predict, their actions. Efficacy beliefs affect thought processes, the level and persistency of motivation, and affective states, all of which are important contributors to the types of performances that are realized. People bring cognitive productions into being by the intentional exercise of personal agency (Bandura, 1997).

Dimensions of Self-Efficacy

Efficacy judgments vary on three dimensions that have important performance implications: magnitude, strength, and generality (Bandura, 1977). Magnitude refers to the level of difficulty of the task at hand that a person believes to be capable of performing. It can range from simple tasks being carried out, extend to moderately difficult or include the most tasking. Typically, magnitude is measured with a yes/no scale and subjects are asked whether they can perform increasingly more difficult levels of a given task (Lust, Celuch, & Showers, 1993). Strength is the conviction one has of performing a particular behaviour, weak, or strong. Those with a strong sense of self-efficacy will persevere despite obstacles and therefore have a higher likelihood of succeeding (an eleven-point confidence scale is employed to capture this dimension with confidence ranging from 0 (no confidence) to 100 (complete confidence)). Generality refers to the extent efficaciousness in certain domains of functioning can extend to other similar behaviours or contexts. With generality, participants are given statements relating to aspects of task performance (Lust et al, 1993). To assess this dimension, Lust et al suggest utilizing a Likert-type format ranging from strongly agree to strongly disagree.

Bandura (1986) emphasized that self-efficacy is specific to a particular behaviour and not a generalized perception of capabilities. When measuring efficacy beliefs, one needs to consider that competence may vary across realms of activity, under different levels of task demands within a given activity domain, and under different situational circumstances (Bandura, 1997). With adherence to a physical activity regime, for example, individuals judge how well they can get themselves to participate regularly when faced with hindrances, such as when they are stressed from work, are tired, or are depressed; in bad weather conditions; or when other commitments or more interesting things take precedence. A thorough analysis of self-efficacy requires a detailed assessment of the three dimensions. A confidence scale, which has been the focus of most studies, examines the strength dimension (Lust et al, 1993; Maddux, 1995).

Sources of Information for Self-Efficacy

Self-efficacy beliefs are constructed from four principal sources of information: performance accomplishments, vicarious experiences, verbal persuasion, and physiological states (Bandura, 1977). According to Bandura (1977), performance attainments provide the most powerful source of efficacy information as it is based on direct, personal experiences. Successes increase self-efficacy whereas failures decrease it. With repeated successes, self-efficacy will be enhanced and the impact of occasional failures will unlikely have much of an effect on personal efficacy (Bandura, 1977). Bandura (1977) points out that once self-efficacy is established, it can be generalized to other similar situations. However, performance successes do not necessarily increase efficacy beliefs nor do performance failures necessarily lower them (Bandura, 1997).

People however, do not rely on mastery experiences as the only source of information concerning their self-efficacy (Bandura, 1977). Vicarious experience, although a weaker source of information, influences self-efficacy expectations when people observe the behaviour of others similar to themselves successfully performing the desired behaviour (Bandura, 1986). This source is more relevant when people lack knowledge on how to perform an activity or when people are uncertain about their capabilities because of inexperience with an activity (Bandura, 1986). The more similar the model is to the person, the higher the personal relevance, although, seeing different types of people master the same difficult task will also increase efficacy (Bandura, 1986). Modeling provides not only a standard to aspire to, but also gives the observer effective skills and strategies (Bandura, 1986).

Verbal persuasion is used to provide faith that one possesses the capabilities enabling goal achievement (Bandura, 1986). Evaluative feedback is provided about ongoing behaviour. It is a less potent source of information than performance and vicarious experience; however, it is widely used because of its ease and ready availability (Maddux, 1995). Maddux (1995) remarks that this source of efficacy is influenced by the expertness, trustworthiness, and attractiveness of the source.

Physiological states influence self-efficacy by the interpretation of the body's response to exercise. Negative responses such as sore muscles or heavy breathing could lead to the perception of poor performance and failure, whereas positive sensations could lead one to feel confident with the current situation (Maddux, 1995). It is therefore important that sedentary, moderately active people understand this aversive behaviour if it is to occur. Maddux (1995) has expanded this source of efficacy to include emotional states as another source where positive affect will enhance performance beliefs. Bandura (1997) suggests altering efficacy beliefs by enhancing physical status, reducing stress levels and negative mood states, and correcting misinterpretations of bodily states.

Information that is relevant for judging personal capabilities whether conveyed enactively, vicariously, persuasively, or physiologically is not inherently enlightening. According to Bandura (1997) it becomes instructive only through cognitive processing and reflective thought. Changes in self-efficacy result from cognitive processing of the information that performances convey with regards to capability. According to McAuley (1992), efficacy cognitions influence duration, intensity, and the amount of exercise and these serve as sources of information for developing future self-efficacy expectations. One of the assumptions of self-efficacy, is that the environment, cognitions, and behaviour all interact with each other (Bandura, 1986). Therefore, self-efficacy beliefs regarding one's exercise capabilities should influence one's exercise participation and depending on the outcome, should increase or decrease future expectations (McAuley & Jacobson, 1991). Efficacy cognitions are directly relevant to the particular behaviour of concern and are subject to change as a function of environmental stimuli (McAuley, 1992; McAuley & Jacobson, 1991).

A number of factors including personal, social, situational, and temporal circumstances affect how personal experiences are cognitively appraised (Bandura, 1986). People's competencies are repeatedly tested; therefore, periodic reappraisals of self-efficacy are required. Individuals with low self-efficacy are sensitive to new information and high self-efficacy can be altered through powerful negative experiences. According to Bandura (1986), the relationship between self-referent thought and action is most accurately revealed when they are measured in close temporal proximity. The intervening experience itself is the relevant factor, not the amount of time that has transpired. McAuley (1992), points out that because exercise is a process and not a static phenomenon, different variables determine different aspects of behaviour in a continuously changing manner and this will affect the adoption or maintenance of exercise.

Types of Self-Efficacy

With most studies, self-efficacy is rated with regards to a specific activity along the strength and magnitude dimensions. However, Lust et al stress the importance of item content. Maddux (1995) identifies two types of efficacy: task-efficacy and coping efficacy. Rodgers and Sullivan (in press) add a third type of self-efficacy to this list, scheduling efficacy. Task efficacy is the confidence one has in performing the actual physical activity behaviour (Maddux, 1995). For example, strength training may be very intimidating to women if they do not know the technique of various exercises and different methods for training. Therefore, if evaluating task efficacy in women on strength training, skills could be provided to increase this type of efficacy.

Coping efficacy refers to the confidence one has in performing the physical activity behaviour when challenging conditions arise (Rodgers & Sullivan, in press). Bad weather, busy schedule, family emergencies can all prevent someone from engaging in physical activity. As identified earlier by Nies et al (1998) and Pinto et al (1996), time and other obligations were barriers to physical activity. Therefore, the first thing to be dropped from one's life when things get hectic, is physical activity. If coping strategies can be realized, these challenges may be overcome and coping efficacy thereby increased. Coping efficacy according to Maddux (1995) is the ability to prevent, manage or control the aversive consequences of a behaviour. Barrier efficacy was a type of efficacy incorporated into several studies (McAuley, 1992; McAuley & Jacobson, 1991). This is similar to coping efficacy whereby participants' were asked to rate their confidence to exercise regularly under various circumstances such as the ability to continue if the exercise progress was too slow or if it conflicted with their work schedule.

The third type of efficacy, scheduling efficacy, is the confidence one has to schedule physical activity into the daily routine (Rodgers & Sullivan, in press). To make physical activity a lifestyle, physical activity needs to be performed on a regular basis. According to Rodgers and Sullivan, scheduling may therefore be an important target for intervention if regular physical activity is the goal. All types of efficacy need to be examined so that interventions can be designed to accommodate different groups of people and the type of efficacy that is low for this group.

Outcome Expectations

The influence of self-efficacy is only observed when adequate incentives for the behaviour are present (Rodgers & Brawley, 1996; Rodgers & Gauvin, 1998). These incentives are associated with the outcomes expected from participating in a particular behaviour. Self-efficacy theory, therefore, provides the framework for examining the self-efficacy-outcome-expectation behaviour relationship (Rodgers & Brawley, 1996). Outcome expectancy is defined as a person's estimate that participation in a given behaviour will produce a certain outcome (Bandura, 1977). An outcome is a consequence of the activity, not the activity itself. For example, when people try to lose weight, they do so for the resulting physical, social, and self-evaluative benefits not just for the sake of losing weight (Rodgers & Brawley, 1996).

Outcome expectation is the product of outcome value and outcome likelihood. Outcome value, was a modification by Maddux, Norton, and Stoltenberg (1986) to the self-efficacy model. It represents the value or importance of the outcome in question to the participant regardless of its likelihood (Rodgers & Brawley, 1991). Outcome likelihood refers to the likelihood of a particular outcome resulting with the completion of a particular behaviour (Rodgers & Gauvin, 1998).

Outcome expectations have also been divided into proximal and distal outcomes (Rodgers & Brawley, 1991) or primary and secondary outcomes (Rodgers and Brawley, 1996). Both sets of outcomes are conceptually the same. Proximal or primary outcomes are those that immediately result from participation in physical activity, for example, increased strength or muscle tone. Distal or secondary outcomes were defined as those outcomes expected as a result of achieving the proximal outcomes, for example, increased confidence as a result of being stronger and more toned (Rodgers & Brawley, 1991)

Self-efficacy and outcome expectations are differentiated from each other, as it can be believed that a particular course of action can lead to particular outcomes, but the behaviour is not carried out because competence in executing the necessary actions is doubted. Both are conceptually distinct and when measured and defined carefully are important predictors of intentions and behaviour (Maddux, 1995). According to Bandura (1997), increases in self-efficacy and positive expectations promote adherence to healthy behaviour.

Attitude, self-efficacy, and outcome expectations, based on expectancy-value principle have a positive relationship to behavioural intentions. Therefore, the more positive the attitude, the higher the efficacy and the more favourable the outcomes, the stronger the intention to perform the behaviour under consideration.

Statement of the Problem

The purpose of this study was to investigate the utility of attitudes toward exercise, self-efficacy, and outcome expectations in a homogenous sample of overweight women. In particular, the usefulness of these variables in conjunction with a physiological study involving acute, exercise bouts of long duration and controlled energy availability (EA) was studied. The reasons for this were threefold. First of all, as pointed out earlier, women are an understudied population, therefore, a study conducted on women would add to the current research on women and exercise. Secondly, most studies on these psychological constructs involve filling out questionnaires either on their own or as part of an exercise intervention to gain knowledge regarding thought processes (Ajzen & Timko, 1986; Ducharme & Brawley, 1995; Fontaine & Shaw, 1995; McAuley et al, 1994; Rodgers & Brawley, 1996). However, this study involved an intense exercise protocol where physiological variables of energy expenditure and energy intake were strictly controlled. The aforementioned psychological constructs provided an adjunct to this physiological investigation. Lastly, limited research has been conducted that differentiates self-efficacy into three types (Rodgers & Sullivan, in press). Therefore, this study will further enhance this area of investigation in the self-efficacy literature.

The Present Study

This investigation was in conjunction with another study looking at the relationship between energy availability and thyroid metabolism to understand the dynamics between energy intake and physical activity. Participants were randomly assigned into one of four experimental conditions: a) 11 kcal/kg FFM/day, b) 19 kcal/kg FFM/day, c) 25 kcal/kg FFM/day, and d) 40 kcal/kg FFM/day. Exercise expenditure was set at 25 kcal/kg FFM/day at a workload of 80-90% ventilatory threshold (VT). The exercise consisted of cycling on a stationary Monarch bike for a duration of 2.5 to 4 hours each of the 3 days depending on each participant's fitness level as determined through a fitness test to volitional fatigue and fat free mass (FFM) as determined through hydrostatic weighing. The intensity and duration was adjusted from previous research in sedentary, normal weight women (Loucks & Callister, 1993; Loucks & Heath, 1994). In these studies, a 30 kcal/kg FFM/day energy expenditure was utilized for four days at an intensity of 90% VT.

Because the study was in an overweight population, several problems were anticipated. Comfort was considered to be a major determinant of adhering to this study. With such a long exercise bout, taking place over a three day period, the intensity and overall duration were lowered because of the increased body fat in this sample. Sitting on a stationary cycle ergometer for such a lengthy time period can be an extremely difficult feat for any individual and extra fat mass can contribute to discomfort. As well, Loucks and Callister (1993) found T_3 levels to be significantly reduced in all the deficient groups within two days; therefore, three days was considered a sufficient duration to determine thyroid levels, instead of the four days used in their study.

With this study consisting of an extended duration to monitor thyroid metabolism, physiological changes were anticipated especially for the lower EA groups. This was measured through daily blood samples while the body responded to the controlled exercise and diet protocol. Exercise has stimulus properties, which will lead to subjective interpretations of the physiological symptoms during and following exercise (McAuley & Courneya, 1994). The physiological interpretations therefore provided an opportunity for the observation of psychological variables. Looking at the physiological components of this long exercise session with varying energy intakes in overweight women, it would be interesting to see how this would affect their attitudes, self-efficacy, and outcome expectations.

Hypotheses

The following hypotheses were investigated:

1) As a result of the duration and intensity of the acute exercise bouts, it was hypothesized that evaluative attitudes would not change; affective attitudes would

decrease; self-efficacy would increase over the three days; and some items for outcome expectations would increase while others would decrease. In particular, it was hypothesized that outcome desirability (OD) would decrease over the four days they were measured for item one, “get sweaty”; item two, “increase your heart rate”; item three “increase your breathing/breathe harder”; item five “feel exhausted”; item 8, “feel more tired and worn out”; item 15, “feel stiff/sore body”; and item 18, “be more tired”. It was hypothesized that outcome likelihood (OL) would decrease for item five, “feel exhausted; item six, “feel satisfied”; and item 7, “feel more alert/awake”. It was hypothesized that OL would increase by day 6 for item 8, “feel more tired and worn out”; item 15, “feel stiff/sore body; item 16, “feel better about yourself/more confident”; and item 18, “be more tired”.

2) Attitudes, self-efficacy, and outcome expectations would be different between participants, with participants in the highest energy availability (EA) group having higher scores by day 6 for attitudes, self-efficacy, and outcome expectations, followed by linear decreases in the remaining three EA groups.

Operational Definition of Terms

1. Exercise:

Throughout this study, exercise and physical activity are used synonymously. These terms refer to "physical activity that is planned, structured, repetitive, and purposive in the sense that improvement or maintenance of one or more components of physical fitness is the objective" (Caspersen Powell, Christensen, 1985, p. 128).

2. Energy Availability:

Energy availability is the difference between energy intake and energy expended with physical activity (Loucks & Callister, 1993).

3. Fat Free Mass:

Fat free mass is the weight of all tissues in the body excluding fat. It is composed of water, protein, and bone mineral (Heyward & Stolarczyk, 1996).

4. Fat Mass:

This is defined as all extractable lipids from adipose tissue and other tissues in the body (Heyward & Stolarczyk, 1996).

CHAPTER 2

REVIEW OF LITERATURE

An extensive review of literature was conducted with the keywords: attitudes, self-efficacy, outcome expectations, exercise, and women. In the articles reviewed, exercise behaviour was the outcome measured. However, explaining exercise in all its complexity is a difficult task (Theodorakis, 1994). The variables used to predict this outcome were the constructs previously described: attitudes, self-efficacy, and outcome expectations, although, not all the articles utilized all three constructs together. Some studies used additional variables to enhance the understanding of exercise behaviour. In total, fourteen empirical studies were reviewed because of their relevance to the current study (Ajzen & Timko, 1986; Ducharme & Brawley, 1995; Fontaine & Shaw, 1995; McAuley, 1992; Mcauley et al, 1995; McAuley, Courneya, et al 1991; McAuley, Courneya, et al, 1994; McAuley & Jacobson, 1992; McAuley et al, 1991; Rodgers & Brawley, 1991; Rodgers & Brawley, 1996; Rodgers & Gauvin, 1998; Rodgers & Sullivan, in press; Wilcox & Storandt, 1996).

Relevant Literature on Attitudes Toward Exercise

Much of the research on exercise and attitudes utilizes the TPB, where attitude is one of five constructs incorporated into this theory (Courneya & McAuley, 1994; Horne, 1994; Kerner & Grossman, 1998; Theodorakis, 1994; Wankel, Mummery, Stephens, & Craig, 1994). Limited empirical investigations involving only attitudes have been conducted in the exercise domain, hence a literature review found only two articles of relevance to the current investigation.

Ajzen and Timko (1986) looked at the relationship between health attitudes and behaviour using the principle of correspondence and applying it to the health locus of control, perceived behavioural control and the health belief model constructs. The principle of correspondence according to these investigators implies that specific health behaviours correlate only with specific attitudes toward those behaviours. Cross sectional in design a questionnaire was filled out one time only. The scales in the questionnaire contained questions representing both specific and broad attitudes, questions associated with the health belief model and the health locus of control scale. Their results found women to be more favourably inclined toward performing health related practices than their male counterparts, but in terms of relations between attitude, perceived control, intention, and behaviour, no difference between gender was found.

Also, none of the global beliefs and attitudes was found to predict specific health behaviour with any degree of accuracy. However, correlations between specific attitudes and the corresponding behaviour were high as well as the degree of perceived behavioural control. Finally, results found health behaviour was predicted with greater accuracy from an affective than from an evaluative measure of attitude. Ajzen and Timko therefore concluded that according to the principle of correspondence, it was more appropriate to assess beliefs regarding control over specific health related behaviours as global attitudes tended to lack correspondence with any specific health behaviour while specific attitudes and perceived behavioural control (PBC) correlated highly with respect to the corresponding behaviour.

Wilcox and Storandt (1996) also examined attitudes in conjunction with self-motivation and self-efficacy. They examined the differences between female exercisers and non-exercisers of varying ages on three psychological variables that are commonly studied correlates of exercise behaviour: self-efficacy, self-motivation, and attitudes toward exercise. Self-efficacy examined participants' confidence in increasingly difficult levels of exercise (walking, jogging, lifting heavy objects, climbing stairs, sit-ups). Attitudes in this study were based on the attitude component of the theory of reasoned action. Through random digit telephone dialing, 121 women stratified by age from ages 20 to 85 and exercise status (exercisers or non-exercisers) were selected. Results for self-motivation found age to be non-significant, however those that were identified as exercisers displayed higher self-motivation than the non-exercisers. With regard to self-efficacy, age was negatively related and accounted for a greater proportion of the variance than exercise status, with exercisers reporting greater self-efficacy. For the construct of attitudes, younger participants and those that exercised had more positive attitudes. In conclusion, Wilcox and Storandt suggest that their results have important implications in designing interventions for older women. The first steps of an intervention would be to change the attitude of exercise being unpleasant, stress the benefits of physical activity, and increasing self-efficacy through verbal persuasion and vicarious experiences.

Relevant Literature on Self-Efficacy and Exercise

A prospective study conducted by Ducharme and Brawley (1995) examined whether two types of efficacy, barrier/coping and scheduling, predicted behavioural intention and actual attendance rates over time; whether past behaviour predicted future behaviour as individuals gained more experience; and whether any changes occurred over time in social-cognitive variables as a function of experience. This investigation, unlike the others reviewed, involved a more unstructured, less regimented and more personally controllable form of exercise, that is, the self-selected forms of activities engaged in by females in the initial stages of exercise at a very large women's health club. Ducharme and Brawley note that in contrast to structured exercise programs, time, duration and intensity in this setting would have to be self-regulated. The questionnaires on self-efficacy with behavioural intention incorporated were filled out at weeks one (to predict behavioural intention and attendance from weeks 1 through 8) and nine (to predict behavioural intention and attendance from weeks 9 through 16). Also, the dependent variable, exercise frequency was monitored by recording attendance each time a participant came in.

The results showed attrition rates to be consistent with the literature with close to 50% dropping out of the study. Also, exercise was two thirds to one half of the recommended three times a week suggested by the authors for cardiovascular benefits. Mean attendance and scheduling efficacy decreased over the 16-week study. Past attendance (weeks 1 through 8) significantly contributed to the prediction of attendance through weeks 9 to16, but scheduling efficacy still explained 16% of the variance. At week 9, scheduling efficacy was the key predictor of attendance, whereas barrier efficacy did not independently and significantly contribute to the prediction of attendance. Both forms of efficacy predicted behavioural intention at weeks 1 and 9, but at week 9, scheduling explained more of the variance, doubling its contribution. Intention, itself was found to be a significant and independent predictor of behaviour. With mastery experiences, exercise initiates recognized the difficulty of planning and scheduling regular exercise sessions. Results suggested that, what regular attendance participants thought they could regularly carry out was less frequent than originally intended.

This study supported self-efficacy. For people who chose to exercise, high self-efficacy in their ability to overcome barriers to exercise and to fit exercise into their weekly schedule was displayed. As well, efficacy cognitions predicted intention, which in turn predicted exercise behaviour. In conclusion, barrier/coping and scheduling efficacy were found to be important in motivating adherence. With the greater contribution of scheduling efficacy to attendance later in a program, the authors suggested that if regular physical activity is the goal, scheduling efficacy should be targeted for intervention purposes.

Research conducted by Fontaine and Shaw (1995) studied the effects of self-efficacy and dispositional optimism on exercise adherence. Cross-sectional in design, a questionnaire was filled out prior to the participation in fitness classes. Self-efficacy in this study examined the extent participants expected to attend at least one class a week each week over the course of 8 weeks. With frequency monitored through attendance, an average of 6.5 sessions were attended over the 8-week duration with 50% of the participants adhering to the study. Results found those who adhered with the exercise program scored significantly higher on self-efficacy compared to those that dropped out. However, there was no difference between the two groups on optimism. Therefore, support for previous research was founded with self-efficacy being an important determinant of certain forms of exercise behaviour. However, optimism-pessimism was not associated with whether one adheres to a program.

In a community sample of sedentary, middle-aged adults, McAuley, Courneya, et al (1991) investigated the effects of acute and long-term exercise on self-efficacy. Specifically, they wanted to see if successful mastery experiences would increase self-efficacy for acute and chronic exercise; determine if there were gender differences with self-efficacy; and examine the relationship between self-efficacy and physiological responses following a 20-week exercise program. Self-efficacy, in this study, looked at confidence in one's capabilities with respect to sit-ups, biking, and walking/jogging. Questionnaires were filled in at baseline and at twenty weeks following graded exercise testing. For the duration of the study, 51.7% of the participants adhered 2-3 times a week and 65% completed both the pre-and post-testing. Significant main effects were found for the physiological responses, as well as on self-efficacy. Both men and women demonstrated a significant increase in self-efficacy following acute and chronic exercise. Females initially had lower perceptions of their physical capabilities than men, however, they continued to demonstrate a linear increase in their efficacy from beginning to the end of the program, equalling or surpassing that of their male counterparts. Biking efficacy decreased in the male sample whereas it linearly increased from beginning to end for females. With regards to self-efficacy and physiological responses, a few significant correlations suggested a relationship between aspects of exercise efficacy and abdominal strength and aerobic capacity, but results were attenuated when considered within males and females. From their research, McAuley, Courneya, et al (1991) found support for past mastery experiences amplifying future self-efficacy cognitions suggesting acute bouts of exercise have a significant impact on cognitions.

Within a social cognitive framework, self-efficacy along with perceptions of success, and intrinsic motivation were examined in a cross-sectional study by McAuley, Wraith, et al (1991). The purpose of the study was to test Bandura's (1986) hypothesis that differing levels on self-efficacy would have differential effects on intrinsic motivation. As well, a second purpose was to determine the degree to which perceptions of success (a self-evaluative mechanism) and self-efficacy were related to intrinsic motivation for aerobic exercise. Participants from the study were drawn from three levels of aerobic exercise classes: beginner, intermediate, and advance. This investigation found beginners to have lower self-efficacy than intermediate participants who had lower self-efficacy than advanced participants. However, beginners and intermediates did not differ significantly from each other whereas advanced differed significantly from the other two. Highly efficacious individuals exhibited greater intrinsic motivation, however the three ability groups did not differ significantly along the dimensions of intrinsic motivation. Self-efficacy and perceived success were both significant predictors of overall intrinsic motivation, however perceived success accounted for more of the variance and self-efficacy appeared to be serving more of an augmenting function. McAuley et al concluded that their findings provided moderate support for Bandura's postulations. They therefore suggested that perceptions of success and self-efficacy might be connected to the development of intrinsic motivation for aerobic activity.

Research conducted by McAuley (1992) examined the role of general and specific self-efficacy in the process of adopting and maintaining exercise behaviour with exercise behaviour assessed in terms of both frequency and intensity (rate of perceived exertion (RPE) and target heart rate (THR)) over a five-month period. General self-efficacy looked at participants' perceptions of their physical self-confidence whereas specific self-efficacy examined participants' perceived capabilities to overcome barriers to exercise. General self-efficacy was proposed to have an effect on exercise only during the initial stages (first 12 weeks) of exercise adoption. Specific self-efficacy, on the other hand, was proposed to have direct and indirect effects on exercise frequency. Therefore, self-efficacy cognitions would influence frequency at week 12 and cognitions at week 12 would influence attendance between weeks 12 and 20.

Sedentary volunteers registered in a community walking program with participants assigned to one of four exercise classes. Measurements of self-efficacy occurred at week three and week twelve whereas physiological measurements of body composition and aerobic capacity were done prior to beginning the program. The physiological measurements were hypothesized to act as sources of information from which general self-efficacy would be determined.

Consistent with other studies, 51.7% of the sample attended two or more sessions per week over the five months. Self-efficacy was shown to predict adoption, but past behaviour proved to be the strongest predictor of subsequent participation and maintenance. General and specific self-efficacy predicted frequency and intensity of exercise, however, each had different roles. With regards to frequency, both efficacies had their effect on mid-program and end-of-program exercise, but specific self-efficacy predicted attendance at three months whereas past behaviour predicted attendance at five months. With regards to intensity, in particular, RPE, general self-efficacy was the predictor at three months while specific self-efficacy was the predictor at five months. The strongest predictor of exercise intensity at program end was intensity at three months. Percent body fat was the only physiological variable significantly correlated with self-efficacy. This had a direct effect on general beliefs about physical capabilities with leaner individuals attending more classes. This study concurred with Bandura's theoretical postulations of self-efficacy playing more of an important role when exercise becomes more difficult, in the adoption phase. This is the phase where exercise was deemed to be more tiring, painful, inconvenient and stressful to the system. McAuley therefore suggested facilitating self-efficacy through the interpretation of physiological and perceptual feedback. He also emphasized the need for longitudinal designs with multiple measurement points as different variables would have different effects on exercise at different stages of the exercise process.

In a cross-sectional study by McAuley and Jacobson (1991), the relationships among exercise behaviour and instructor influence, self-efficacy cognitions, self-motivation, and body composition (body weight, % body fat) in a university sample of 58 sedentary women were examined. Participants volunteered to participate in an eight-week aerobic exercise program with pre- and post-program questionnaires completed as well as a follow-up assessment three months after program completion. Also aerobic exercise outside of the program setting was recorded to determine overall exercise participation. Participants were therefore classified into either good or poor program attenders as well as good or poor overall participants at exercise done in and out of the program setting.

Results found the mean attendance rate to be 10.73 sessions out of a total of 16 sessions. There was a significant, but moderate main effect for body weight when comparing those individuals who participated more in the program to those who poorly attended. Good attenders were found to be lighter in weight. As well, they lost weight over the duration of the program. On the other hand, poor attenders were heavier and gained a small amount of weight over the program duration. However, when looking at overall exercise participation, no difference was found for body weight. These investigators suggested that heavier individuals may choose or prefer to exercise on their own rather than attend a fitness class.

Efficacy for overcoming commitment barriers was more strongly related to attendance with good program attenders and overall exercise participants more efficacious than their poor program attender and low overall exercise counterparts. Good and poor program attenders differed significantly on their perceptions of the program and their involvement in the program with good attenders being more positive, more successful, and achieving their exercise goals. Self-motivation was non-significant in this study. Lastly, instructor influence contributed a significant proportion of the variance in program attendance. McAuley and Jacobson suggested that strategies such as goal setting and keeping fitness logs could enhance mastery experiences and performance information, which would in turn enhance self-efficacy.

McAuley et al (1994) wanted to determine the utility of an efficacy-based information intervention in sedentary middle-aged adults over a five-month time frame. Participants were randomly assigned, into either an exercise plus intervention or an exercise plus attention control group with the intervention beginning at week three of the program. The focus of the intervention was information provided on the four sources of self-efficacy. Measures of exercise behaviour (frequency, duration, and distance) and adherence self-efficacy assessed the effects of the intervention on adherence. Adherence self-efficacy, belief in one's capability to continue to exercise on a regular basis at a prescribed frequency, intensity, and duration, was measured at the beginning of the program and at the end of each month.

As a total group, participants attended 61% of all possible classes with the treatment group attending 67% compared to 55% by the control group. Therefore, adherence patterns were slightly higher than the typically reported 50%. The study found a significant treatment effect with participants in the intervention group exercising more frequently, for a longer duration, and walking greater distances over the course of the program. Self-efficacy was found to be a significant predictor of exercise behaviour in the early and middle stages of the exercise program but not during the last month. Gender predicted only initial self-efficacy at month one with males having higher efficacy expectations and thereafter gender was non-significant. Support for McAuley (1992) was found with self-efficacy important in the adoption stages of exercise and past experience predicting future behaviour. Despite the link between self-efficacy and exercise participation and the treatment effect of the intervention, the effect of the treatment on adherence was direct rather than through self-efficacy as hypothesized. In interpreting these results, the authors commented that the intervention may have influenced other determinants of exercise behaviour. The intervention, although on the sources of self-efficacy, may have had the effect of changing attitudes toward exercise, increasing social support or acting as a behaviour modifier. Also, the frequency of self-efficacy measurements, that is the temporal sequencing, may not have been sensitive enough to capture the effects of the intervention. McAuely et al (1994) suggested future research to investigate the intervention effect on self-efficacy and behaviour.

In a telephone survey, Rodgers and Sullivan (in press) wanted to demonstrate the differing ability of the specific types of self-efficacy to discriminate among groups with varying levels of exercise involvement. Two small pilot phone surveys were conducted prior to the main study to determine clarity and understanding of the questions. For the main study, random digit dialing was carried out to obtain equal representation in five stages of physical activity involvement and to ensure all participants were over 18 years old. These authors identified the need for consistency in the definition and operationalization of self-efficacy as well as differing assessments of the three dimensions of self-efficacy. It was hypothesized that non-exercisers and exercisers would be distinguished by coping and scheduling efficacy but not by task efficacy.

A main effect was found for frequency of exercise and the different types of self-efficacy. A multivariate difference between the groups was found for task efficacy, which was unexpected as well as for coping and scheduling efficacy. However, coping and scheduling efficacy accounted for three times the variance than task efficacy. They therefore were considered better discriminators of the exercise categories. There were also no clear between group differences for task efficacy identified providing some support for the investigators' hypothesis. Exercisers had high task, coping, and scheduling efficacy whereas non-exercisers had high task, low coping, and low scheduling efficacy. According to Rodgers and Sullivan, knowing how to do the exercise was not a barrier to exercise, but rather decreased ability to schedule and overcome other obstacles associated with exercise adherence. In particular, lack of time was identified as a key barrier between groups from a discriminant function analysis. The authors suggested changing the focus in research from what motivates physical activity to what hinders it with interventions targeting scheduling efficacy and related skills.

Relevant Literature on Outcome Expectations

An investigation conducted by McAuley et al (1995) examined self-efficacy, outcome expectations and physique anxiety in sedentary, middle-aged adults. The purpose of their study was twofold: to replicate the findings of McAuley, Courneya, et al (1991) by examining the effects of acute and chronic exercise on self-efficacy and secondly, to determine if initial outcome expectations and changes in self-efficacy contributed to changes in physique anxiety. Three measures of self-efficacy were employed with two focused on different types of exercise (biking and walking/jogging) and the third on general physical capabilities (strength, speed, and muscle tone). Outcome expectations examined certain fitness and health outcomes that would accrue from participation in the program. Like McAuley, Courneya, et al, participants underwent a 20-week program comprised of walking for one hour, three times a week with physiological testing taking place prior to the program and upon program completion.

Attendance was monitored daily and overall, 67% adhered to the program, while 84% participated in pre- and post-testing. Both acute and longitudinal exercise participation resulted in significant increases in self-efficacy, however there was a more dramatic increase with chronic exercise participation. A reduction in negative body image was a function of both psychological and physiological influences with higher self-efficacy, positive expectations, and decreased body composition and circumferences decreasing physique anxiety. Males in general were more efficacious than females at each measurement point, however none of these differences were significant. The only consistent differences between men and women existed at the univariate level for biking. Therefore, this study supported McAuley, Courneya et al's 1991 research with acute and longitudinal exercise participation acting as important sources of information impacting both general and specific self-efficacy and the role social cognitive variables played in self-presentational outcomes. However, no support for the gender differences was found.

Rodgers and Brawley (1991) researched the role of outcome expectancies in participation motivation and a method of analysis. They conducted two studies with pilots done prior to both to develop the questionnaires. In the first study, the primary question was whether or not outcome likelihood and outcome value were psychometrically useful relative to importance, another measure typically used in the participation motivation literature. Participants were 195 undergraduates enrolled in a kinesiology course.

In study two, gender and activity were controlled to examine outcome expectations of females engaged in a specific activity, strength training. Outcome expectations were divided into proximal and distal outcomes. It was argued that proximal outcomes would receive higher ratings than distal outcomes. As in study one, the purpose of study two was to illustrate the benefit of including both outcome likelihood and value for a measure of outcome expectancy. The results of the two exploratory studies provided support for outcome expectations in describing motives. From study two, proximal and distal outcomes were differentiated, that is, they did not have the same potential motivational role. Distal outcomes were found to be not as highly valued as proximal outcomes, supporting the investigators' earlier arguments.

Rodgers and Brawley therefore suggested taking into account participants' perceptions of why they exercised and whether the measures used can answer this question.

Rodgers and Brawley (1996) examined the use of self-efficacy and incentives in predicting behavioural intention to continue exercising among 52 initiate weight lifters. They also wanted to consider the proposed relationship at more time points than previous exercise studies. It was therefore hypothesized that incentives would predict behavioural intention just before initiating the new behaviour while self-efficacy would be the dominant predictor after gaining experience with the activity. Self-efficacy was concerned with efficacy for both weights training skills and attendance at the weekly training sessions.

The investigators found incentives to play a role in the prediction of behavioural intention independent of self-efficacy. Primary incentives expected of post-clinic participation independently predicted the variability in pre- and post-clinic future intentions beyond the variability predicted by self-efficacy. Intention was found to decrease for all participants. Incentives and self-efficacy discriminated between individuals extreme in the strength of their intention at pre- and post-clinic. Although, low intention individuals could be confident in their ability to carry out the necessary actions, but just did not perceive any merit from doing so. Support was therefore found for the impact of incentives and the joint influence of outcome expectations and self-efficacy on physical activity. This in turn influenced future intentions of those initiating and adopting exercise.

In a cross-sectional study by Rodgers and Gauvin (1998), 86 women volunteered from local fitness clubs. An incentives approach was employed, which included outcome value and outcome likelihood along with self-efficacy in the prediction of behavioural intention and behaviour. The purpose of the investigation was to examine whether persons exercising two times a week or less or three times a week or more with intentions to maintain current activity level formed a homogenous group in terms of motivational features. Utilizing stage theory, the 86 women chosen were conceptualized as being in the maintenance stage with 32 being moderately active and 54 highly active.

The investigators found self-efficacy discriminated highly active women from moderately active women: Self-efficacy for highly active was maintained whereas it decreased for those who were moderately active. Highly active women also reported higher incentives for mental health and stress reduction. However, there were similarities with other incentives such as fitness, appearance, and health. Rodgers and Gauvin found the stages of change theory to be useful in describing the motivational features of individuals who exercised at a higher frequency in the process of adoption and maintenance of exercise. In conclusion, the investigators noted the importance of specifying the behavioural criterion of two versus three times per week as these groups were differentiated from each other in their investigation, therefore, the operationalization of the stages of change needs to be further discussed.

Discussion of the Literature

Each study, although on physical activity, differed significantly in terms of the population studied, the setting the research was conducted, and what was measured. The population consisted of adults, both men and women, with an emphasis on women in all studies and some studies were comprised only of women (McAuley & Jacobson, 1991; Rodgers & Gauvin, 1998; Wilcox & Storandt, 1996;). Participant characteristics ranged from university students, faculty staff, university employees to volunteers in the community. The smallest sample size consisted of 52 people and the largest of 265 people with ages ranging from 18, the youngest participant, to 64, the oldest participant. (See table 1 for participant characteristics).

Research included 10 cross-sectional studies and four longitudinal. The longitudinal studies were quite short, all being 20 weeks in duration (McAuley, 1992; McAuley, Courneya et al, 1991; McAuley et al, 1994; McAuley et al, 1995). Measures were all in the form of questionnaires, although frequency through attendance was monitored in several studies and physiological measures were obtained by some of the investigations. In all the articles exercise behaviour was the outcome measured with the exception of Ajzen and Timko who examined health behaviour. Three studies conducted pilot studies to increase content validity. (See table 2 for key findings of the reviewed studies).

Exercise is a complex behaviour involving many variables. The variables used to predict this outcome were the constructs of attitudes, self-efficacy, and outcome expectations, although not all three constructs were investigated together. Some studies utilized additional social cognitive variables to enhance the understanding of exercise adherence: optimism, behavioural intention, physique anxiety, self-motivation, and perceptions of success. Physiological measurements (such as body composition, cardiorespiratory function, abdominal strength, and cholesterol) and their influence on the psychological constructs were included in a few investigations (McAuley, 1992; McAuley et al, 1995; McAuley, Courneya, et al, 1991; McAuley & Jacobson, 1991).

Instructor influence was another independent variable incorporated into the study by McAuley and Jacobson (1991).

With regards to self-efficacy, the studies employing this construct all had considerable variance in how self-efficacy was defined and operationalized. Barrier/coping self-efficacy was examined by McAuley and Jacobson (1991) as well as by McAuley (1992) who also examined general/task self-efficacy. Both barrier/coping and scheduling self-efficacy were used by Ducharme and Brawley (1995). Aerobic self-efficacy with regards to the extent a participant expected to attend at least one class per week for eight out of eight weeks, seven out of eight weeks, six out of eight weeks, five out of eight weeks, or four out of eight weeks was measured by Fontaine and Shaw (1995). Self-efficacy for specific exercises such as biking, walking/jogging and general physical capabilities was looked at by McAuley et al (1995) and by McAuley, Courneya, et al (1991). Adherence efficacy was studied by McAuley et al (1994) as well as by Rodgers and Gauvin (1998). Efficacy based on specific intensity, duration and frequency was measured by McAuley, Wraith, et al (1991). Self-efficacy in the study by Rodgers and Brawley (1996) was measured by questions rating confidence with regards to weight training and attendance at a weekly training session. In Wilcox and Storandt's 1996 investigation, self-efficacy rated confidence for increasingly difficult levels of exercise. With the inconsistencies in the self-efficacy-exercise research, Rodgers and Sullivan (in press) differentiated three types of self-efficacy: task, coping, and scheduling.

Only a few studies examined outcome expectations and self-efficacy together (McAuley et al, 1995; Rodgers & Brawley, 1996; Rodgers & Gauvin, 1998). As noted earlier by Bandura (1977), adequate skills and incentives influence participation.

Therefore, self-efficacy theory provides the framework for the examination of the self-efficacy-outcome expectancy behaviour relationship, yet only a few studies included outcome expectations in their operationalization of self-efficacy theory.

Attendance was the dependent variable measured in some of the studies with measurements occurring in the university fitness classes for several studies and in the community setting at fitness facilities for several studies. The highest attendance rate was 2-3x per week (McAuley, 1992; McAuley, Courneya, et al, 1991). Fontaine and Shaw (1995) found participants attended the step class only 6.5 times over eight weeks, not even once a week. McAuley and Jacobson (1992) found participants attended 10.73 sessions out of a possible 16 sessions on average. No action was really obtained by Fontaine and Shaw's study with exercise not even occurring an average of once a week. As well, very minimal physical activity was undertaken in McAuley and Jacobson's study with exercise occurring just over once a week. Neither of these studies had enough physical activity to provide fitness or health benefits. Attrition patterns were consistent in the investigations reviewed: an average of 50% dropping out. Although McAuley et al (1995) and the treatment group in McAuley et al's 1994 study had a 67% adherence rate.

The behaviour measured for each sample was under the umbrella term of physical activity or exercise with different types of exercise being examined: walking/jogging, step aerobics, low impact aerobic exercise, aerobic dance, and weight training. While the exercise was structured in most studies, no real guidelines were used. A lot of variation occurred between studies. Some studies monitored frequency through attendance while the study by McAuley et al (1994) also looked at distance and duration. Frequency, intensity and duration were examined by McAuley (1992) and by McAuley, Wraith, et al (1991). However, McAuley's study was based on the 1978 ACSM guidelines.

In general, from the studies reviewed, attitudes, self-efficacy, and outcome expectations were supported. Specifically, with regards to attitudes, Azjen & Timko (1986) found attitudes with respect to specific health behaviours correlated highly with the corresponding behaviour. These authors found that health behaviour was predicted with greater accuracy from an affective than from an evaluative measure of attitude. Wilcox and Storandt (1996) found younger women to have more positive attitudes over older women and exercisers to be more positive than non-exercisers.

Self-efficacy is always a robust theory, however various findings resulted. Ducharme & Brawley (1995) found self-efficacy decreased over their 16-week investigation and scheduling efficacy explained more of the variance than barrier/coping efficacy. Past behaviour predicted attendance more than self-efficacy (Ducharme & Brawley, 1995; McAuley, 1992). Self-efficacy predicted adoption in several studies (Ducharme & Brawley, 1995; McAuley, 1992; McAuley et al, 1994). Self-efficacy was found to be greater in advanced participants compared to intermediate or beginner participants (McAuley, Wraith, et al, 1991); exercisers and younger participants versus non-exercisers and older participants (Wilcox & Storandt, 1996); and highly active women compared to moderately active women (Rodgers & Gauvin, 1998). Finally, exercisers and non-exercisers in the study by Rodgers and Sullivan both displayed high task efficacy, however scheduling and coping efficacy were significantly higher in exercisers. Coping and scheduling accounted for three times more between group variance in their study. Gender differences were examined by three studies with different results (McAuley et al, 1995; McAuley, Courneya, et al 1991; McAuley et al, 1994). Only the study by McAuley, Courneya, et al found a gender difference with females showing a linear increase in self-efficacy from the beginning of the investigation until the end, whereas men were found to have a steady state with walking but self-efficacy decreased for them with regards to biking.

With outcome expectations, positive outcome expectations decreased physique anxiety (McAuley et al, 1995). Outcome expectations described motives and distal outcomes were not as highly valued as proximal outcomes in the study conducted by Rodgers and Brawley (1991). For individuals who were highly active, higher incentives for mental health and decreased stress were displayed, but similarities between highly and moderately active were shown for all other incentives (Rodgers & Gauvin, 1998).

Only a few studies examined self-efficacy and outcome expectations together (Rodgers & Brawley, 1996; Rodgers & Gauvin, 1998). These two studies provided support for the impact of incentives and the joint influence of outcome expectations and self-efficacy on physical activity. However, Rodgers and Brawley (1996) said that individually they were insufficient to motivate behaviour.

Measurement Strengths

Face or content validity was improved by conducting a pilot study prior to the actual study. Several of the reviewed articles employed a pilot study to develop valid and reliable psychometric instruments to make questionnaires or scales more context, action, time and population specific (Azjen & Timko, 1986; Rodgers & Brawley, 1991; Rodgers & Sullivan, in press). In other studies, questionnaires were based on measurements recommended for self-efficacy by Bandura (1977), therefore also contributing to high construct validity. Another strength was that some of the studies identified a target population. By narrowing a population of interest to a more homogenous one, it was easier to control for differences. For example, Ducharme and Brawley's (1995) study looked at women who were beginners in an unstructured setting, whereas McAuley and Jacobson (1992) examined sedentary women. Rodgers and Gauvin (1998) examined women in the maintenance stage of exercise. Lastly, Wilcox and Storandt (1996) had women from a community sample participate in a telephone survey.

Limitations

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External validity is one limitation to the studies reviewed. Most of the studies conducted consisted of active individuals or those participants who had joined a structured fitness class or who had joined a fitness facility. Therefore, the studies were based on healthy volunteers motivated to become active or lead a healthier lifestyle. Inferences from these participants to the more unmotivated general population may be difficult due to the lack of representation of unmotivated individuals participating. Only the study by Rodgers and Sullivan examined people in different stages of exercise participation, although several investigations examined exercise behaviour in non-exercisers and exercisers. Maintenance was examined by Rodgers and Gauvin (1998) with women being either highly active or moderately active. More research is therefore needed at earlier versus later stages of exercise behaviour.

Pilot studies, although an advantage to content validity, can also limit external validity. Pilot studies are specific to a particular population of study, therefore, there is a limitation to generalizability or comparability across studies (Kerner & Grossman, 1998). In the research carried out, various forms of physical activity were measured, whether it was vigorous, moderate, or aerobic. Therefore, frequency, intensity, duration and type of exercise varied from study to study making connections with other experiments difficult.

Random sampling of participants occurred in only two studies once participants were recruited for the study (McAuley, Courneya et al 1991; McAuley et al, 1994). The study by McAuley, Courneya et al (1991) also had a control group thereby increasing the validity of self-efficacy as an intervention. Random digital dialing occurred in the studies by Rodgers and Sullivan (in press) and by Wilcox and Storandt (1996).

Small sample sizes, less than 100 for several of the investigations (Ducharme & Brawley, 1995; McAuley & Jacobson, 1991; Rodgers & Brawley; 1991 for their second study; Rodgers & Brawley, 1996; Rodgers & Gauvin, 1998) were also a limitation to external validity. There was a general consensus by all the studies that the self-reported measures contributed to the limitation of the results received. Subjective reporting may be compromised by inaccurate recall or response bias.

The primary goal of social-cognitive constructs is to predict and explain exercise behaviour (in this context). To understand the determinants of physical activity, attitudes, self-efficacy, and outcome expectations were applied by these articles so that what differentiates active individuals from their inactive counterparts can be identified and appropriate interventions may then be designed and implemented.

Gaps in the Literature

The usefulness of attitudes, self-efficacy, and outcome expectations is founded, however, more studies are needed in specific populations, in particular, more studies on women and overweight populations who have the most to gain in terms of health benefits. Also, as mentioned earlier, studies that examine different stages of exercise involvement to further understand exercise behaviour are lacking, therefore, more research is required. More longitudinal studies need to be done, to study the effect of time on psychological constructs and behavioural measures. Also, more standardized definitions of activity are required with regards to frequency, intensity, duration and type of exercise so that research on these constructs and physical activity can be more easily compared and contrasted. Lastly, there needs to be better definitions and operationalizations of the constructs established.

The current investigation hoped to fill in some of the gaps identified. Conducting research in overweight women, with energy expenditure and energy availability strictly controlled would provide insight into this understudied population. In the review, older and younger participants' attitudes were examined, as well as differences in attitudes between gender. However, it was not mentioned, if overweight individuals would have more positive or negative attitudes. The current study would identify overweight womens' attitudes with regards to exercise. From the current literature, because attitudes correlated highly when they corresponded with the specific behaviour, the questionnaire used in this study incorporated questions relevant to exercise. Azjen and Timko (1986) found health behaviour to be predicted with greater accuracy from an affective than from an evaluative measure of attitude. It was hypothesized in this study that evaluative attitudes would not change. Most people know the value of doing exercise; therefore, the evaluation of whether exercise is beneficial should indicate positive attitudes. However affective attitudes as a result of the long duration in this study should decrease which would concur with Azjen and Timko.

Incorporating outcome expectations along with self-efficacy would add to the literature on the studies that have examined self-efficacy and outcome expectations together. Also, by looking at the three types of efficacy, as differentiated by Rodgers and Sullivan (in press), further support would be provided for their operationalization of self-efficacy. It was also hypothesized that self-efficacy would increase as a result of this acute exercise experience. Because self-efficacy predicted adoption in several of the reviewed articles (Ducharme & Brawley, 1995; McAuley, 1992; McAuley et al, 1994), self-efficacy was therefore a determinant of exercise behaviour early in a program. Therefore, if self-efficacy increased as a result of participating in this study, the result could be adoption of an exercise program.

Table 1.

Attitude, Self-Efficacy, and Outcome Expectations Review Table: Sample Characteristics

Author(s)	Title	Population	Age	Behaviour
Ajzen & Timko (1986)	Correspondence Between Health Attitudes & Behaviour	Pilot: 40 men & women Main: 113 (42 men, 71 women) Undergraduates	Mean=20	Health-related behaviour
Ducharme & Brawley (1995)	Predicting the Intention and Behaviour of Exercise Initiates Using Two Forms of Self-Efficacy	63 women @ women's fitness club Novices (90% 1st time joining club) (51% exercised infrequently prior to study, 40% inactive, 9% exercised elsewhere)	Mean=26	Ex. (<structured, self-selected)
Fontaine & Shaw (1995)	Effects of Self-Efficacy and Dispositional Optimism on Adherence to Step Aerobic Exercise Classes	148 women, 6 men 88% students, 12% faculty Volunteers	Range: 18-54 Mean=22.9	Ex. (Step aerobics)
McAuley, Bane, & Mihalko (1995)	Exercise in Middle-Aged Adults: Self- Efficacy and Self-Presentational Outcomes	58 women, 56 men in community setting Sedentary Volunteers	Range: 45-64 Mean=54.5	Ex. (walking)
McAuley, Courneya, Rudolph, & Lox (1994)	Enhancing Exercise Adherence in Middle Aged Men and Women	125 women & men in community setting Sedentary Volunteers	Range: 45-64 4 age cohorts	Ex. (walking)
McAuley (1992)	The Role of Efficacy Cognitions in the Prediction of Exercise Behaviour in Middle-Aged Adults	53 women, 50 men in community setting Sedentary Volunteers	Range: 45-64 4 age cohorts Mean=54	Ex. (walking)
McAuley, Courneya, & Lettunich (1991)	Effects of Acute and Long-Term Exercise on Self-Efficacy Responses in Sedentary, Middle-Aged Males and Females	53 women, 50 men in community setting Sedentary Volunteers	Range: 45-64 4 age cohorts Mean=54	Ex. (walking)
McAuley & Jacobson (1992)	Self-Efficacy and Exercise Participation in Sedentary Adult Females	58 Females (students and staff) Sedentary Volunteers	Mean=39	Ex (low impact aerobic ex.)
McAuley, Wraith & Duncan (1991)	Self-Efficacy, Perceptions of Success, and Intrinsic Motivation for Exercise	254 women, 11men University population 3 levels: 1. Beginner (100) 2. Intermediate (109) 3. Advanced (56)	Mean=20.73	Ex. (aerobics dance class)
Rodgers & Sullivan (1999)	Task, Coping, and Scheduling Efficacy In Relation to Frequency of Physical Activity	Pilot 1: 33 Pilot 2: 27 Main: 203 adults (= representation in 5 behavioural categories & of men & women in community sample)	Over 18	Ex./P.A.

Ex = Exercise; PA = Physical Activity; T = Theory

Table 1. (Continued)

Attitude, Self-Efficacy, and Outcome Expectations Review Table: Sample Characteristics

Author(s)	Title	Population	Age	Behaviour
Rodgers & Gauvin (1998)	Heterogeneity of Incentives for Physical Activity and Self-Efficacy in Highly Active Women Exercisers	86 women from local fitness clubs (32 moderately active, 54 highly active) Maintenance Stage (Stage T)	Mean=38.3	Ex. Programs
Rodgers & Brawley (1996)	The Influence of Outcome Expectancy and Self-Efficacy on the Behavioural Intentions Of Novice Exercisers	31 women, 20 men, 1 unknown University sample Novices @ weight training	Mean=22.5	Weight Training
Rodgers & Brawley (1991)	The Role of Outcome Expectancies in Participation Motivation	Pilot: 66 university students (60% female, 40% male) Study 1: 195 undergrads (60% female, 40% male) Highly active (2-3x/wk) Pilot: 39 female university students Study 2: 15 females interested in wt. tr. Active in recreational p.a.	Pilot: mean age=20.5 Study 1: mean age=19 Study 2: mean age=32.5	Study 1: P.A. Study 2: Weight Training
Wilcox & Storandt (1996)	Relations Among Age, Exercise and Psychological Variables in a Community Sample of Women	121 women Community sample	Stratified by age from ages 20-85 & ex. Status	Ex. (walking, jogging, stairs, sit-ups)

Ex = Exercise; **PA** = Physical Activity; **T** = Theory

Table 2.

Key Findings of the Reviewed Studies

Author(s)	Design/Measures	Purpose	Results
Ajzen & Timko	- Cross-sectional - Self-reported ?/1 time only - Questions on att. & beliefs about H-related B based on: 1. Specific & broad att. 2. HB Model 3. H L of C	To examine the relation between health att. & B using the Principle of Correspondence & applying it to H L of C, PBC & HB Model constructs.	1. Women more favourably inclined toward performing H related practices, but in terms of relations between att., PBC I, & B, no difference between sexes. 2. No global beliefs & att. predicted specific HB with any accuracy.
Ducharme & Brawley	- Prospective version of SET with BI incorporated - 16 weeks long - assessments @ week 1 & 9 1. Barrier SE 2. Scheduling SE 3. BI 4. Attendance	To address 3 issues: 1. SE: barrier & scheduling 2. < structured, < regimented more personally controllable ex. (i.e. self-selected) 3. Examine < studied ex. initiates Specific purpose: 1. Examine whether barrier & scheduling SE predicted BI & actual attendance rates over time 2. Determine if past B plays role predicting future B as individuals gain more experience 3. Determine if any changes occurred over time in SC variables as a function of experience	1. Mean attendance & scheduling efficacy ↓ over 16 weeks. At week 9, scheduling SE key predictor of attendance, whereas barrier SE did not independently and significantly contribute to prediction of attendance. 2. Drop-outs = 25 3. Ex. was 2/3 to ½ of recommended 3x/wk recommended to achieve cardiovascular H benefits 4. Support for SET: for people who chose to ex., they were confident they could overcome barriers to ex. & fit ex. Into weekly schedule. 5. Both forms of efficacy predicted BI @ wks 1 & 9, scheduling explained more variance. 6. I sig. & independent predictor of B. 7. Past attendance (wks 1-8) significantly contributed to prediction of wks 9-16 attendance, but scheduling SE still explained 16% of variance. Scheduling SE important predictor of ex. attendance later in a program, therefore, an important target for intervention if regular p.a. is goal.

Table 2. (Continued)

Key Findings of the Reviewed Studies

[illegible]	Design/Measures	Purpose	Results
Fontaine & Shaw	- Cross-sectional - 8 weeks long Measures: 1. Optimism 2. Aerobic SE: extent they expected to attend @ least 1 class/wk for a) 8/8 b) 7/8 c) 6/8 d) 5/8 e) 4/8 3. Attendance	To examine the effects of domain specific (SE) & generalized expectancies (dispositional)	1. 75 dropped out, 79 adhered 2. Mean attendance = 6.5 sessions over 8 weeks. 3. Adherers scored significantly higher than dropouts did on SE. 4. Therefore, support for previous research: SE important determinant of certain forms of ex. B & optimism-pessimism does not seem to be associated with whether one adheres to program.
McAuley, Bane & Mihalko	- Acute & longitudinal (20 weeks 3x/wk for 1 hour of walking) - Measures: 1. SE (biking, walking/jogging, general physical capabilities: strength, speed, muscle tone) Evaluated 4x (before & after GXT each time) 2. OE (certain fitness & H outcomes) 3. Physique Anxiety (SPAS) Evaluated @ baseline & 20 wks 4. Physiological (cardiorespiratory function & body composition) Evaluated @ baseline & 20 wks 5. Attendance	1. To replicate McAuley, Courneya, et al's 1991 study: the effects of acute & chronic ex. on SE. 2. To determine if initial OE & changes in SE contribute to changes in physique anxiety.	1. Overall attendance: 67%, however 84% did pre- & post-testing. 2. Both acute & longitudinal participation in ex. resulted in sig. ↑ in SE. 3. Therefore, support for McAuley et al's 1991 study that both acute & longitudinal ex. participation act as important sources of information that impact on changes in both specific & general SE. 4. Participants significantly reduced weight, % body fat, and circumferences by program end 5. ↑ SE, +OE, & ↓ hip circumferences ↓ physique anxiety. 6. Chronic ex. participation, more dramatic ↑ SE 7. Failed to replicate McAuley et al's (1991) gender difference although males in general more efficacious than females @ each measurement point. Sig. multivariate effects for sex, but consistent differences between men & women existed only @ the univariate level with respect to biking.

Table 2. (Continued)

Key Findings of the Reviewed Studies

Author(s)	Design/Measures	Purpose	Results
McAuley, Courneya Rudolph, & Lox	- Longitudinal (5 months) - Intervention (walking program: 3x/wk) - RA @ wk 3 into either: a) ex. + intervention (SE from the 4 primary sources) b) ex. + attention control - Measures: 1. Ex. B (assessed daily): a) Attendance (frequency) b) Duration, 2. SE (adherence efficacy: capability to continue to ex. On a regular basis) (assessed @ the beginning & end of each month)	To determine the utility of efficacy based information intervention in sedentary, middle-aged adults	1. Sig. tx effect with subjects in the intervention group exercising more frequently, for longer duration, & walking > distances over the course of the program. 2. The effect of the tx on adherence was direct rather than through SE as hypothesized 3. SE sig. predictor of ex. B in the early & middle stages of ex. program, but not during the last month. 4. Sex predicted only initial SE at month 1, & hereafter was non-sig. with males having > SE expectations in 1st few months. 5. As a total group, subjects attended 61% of all possible control
McAuley	- Longitudinal (5 months) - Measures: 1. Ex. B (designed in accordance with the ACSM 1978 guidelines): a) attendance (f: 3x/wk) b) intensity (RPE, THR: 65-75%) c) duration (15-20 min.) 2. SE (general & ex. Specific (barrier)) Evaluated @ 3 & 12 wks. In order for subjects to determine accurately SE for overcoming barriers, need to 1st experience what barriers might be. 3. Physiological: body comp. & aerobic capacity Hypothesized to act as sources of information	- To examine the role of SE in the process of adopting & maintaining ex. B with ex. B assessed in terms of both f & int. Over 5 mo. pd. a 5 month period (deemed long enough for H & fitness benefits to occur & for determining those variables which influence adoption & maintenance of ex. B). - SE cognitions proposed to influence ex. f @ week 12. F @ week 12 theorized to influence attendance between week 12 & 20. - Thus specific SE proposed to have direct & indirect effects on ex. f. - General SE effects on ex only during initial stages (1st 12 weeks of ex. adoption)	1. 51.7% of sample attended 2+ sessions over 5 mos. 2. SE shown to predict adoption, but B proved to be the strongest predictor of sub-sequent participation. 3. General & exercise SE predicted f & int of ex., however different roles: with f, ex. SE predicted attendance @ 3 mos but not @ 5 mos (past B did), with int, general SE sig. predictor @ 3 mos, whereas ex. SE sig. predictor @ 5 mos 4. The strongest predictor of ex. int @ program end was int @ 3 mos. 5. % body fat, was the only physiological variable that significantly correlated with SE:-direct effect on general beliefs about physical capability and on frequency of ex. 6. Leaner individuals attended more classes.

Table 2. (Continued)

Key Findings of the Reviewed Studies

Author(s)	Design/Measures	Purpose	Results
McAuley, Courneya, & Lettunich	- Acute & longitudinal (20 weeks) - RA into 1 of 4 ex. classes (1 hour, 3x/wk) - Measures (assessed pre- & post study) 1. SE (sit-ups, biking, walking/ jogging) 2. Physiological (body comp, cardiorespiratory fitness, ab. strength, & cholesterol)	1. Successful mastery experience will ↑ SE for acute & chronic ex. 2. To determine if there are gender differences with SE. 3. To examine the relationship between SE & physiological responses following ex. program.	1. 51.7% adhered 2-3x/wk 2. 65% completed pre- & post-testing 3. Participants as a group showed ↑ SE from pre- & post-testing, therefore, support for past mastery experiences serving to amplify future SE cognitions & suggest acute bouts have sig. impact on cognitions. 4. Both men & women demonstrated sig. ↑ in SE following acute ex. 5. In ex. program, women with initially lower perceptions than men, made dramatic ↑ in SE, = or surpassing those of men. 6. Strength of SE: for men: steady state for walking, but for biking ↓, for women: linear↑ from beginning to end. 7. Body comp-body wt/% body fat ↓ over the 20 wks.
McAuley & Jacobson	- Cross-sectional (pre-, post-, FU) - 8 weeks duration, 2x/wk - 1st ? 1 wk prior to ex. Program - 2nd ? at program end - 2 mo FU on SE & self-reported ex. B - Measures: 1. Biometric (wt, % body fat) 2. SM 3. SE (barriers) 4. Instructor Influence 5. Attendance (weekly basis) 6. Daily aerobic ex. (outside of sessions, > 15 min)	- To examine the importance of selected psychosocial & biometric variables in the prediction of ex. B in sedentary adult females. - Specifically, to examine the relationships among ex. B & instructor influence, SE cognitions SM, & Body Comp.	1. Mean attendance rate: 10.73 out of 16 sessions. 2. Good & program attenders differed significantly on body wt. (modest) – good attenders were lighter and ↓ wt over the course of the program. 3. Good attenders & ex. participants were uniformly more efficacious than counterparts. 4. Efficacy for overcoming commitment barriers more strongly related to attendance. 5. Individuals who ex. more regularly ↑ SE (more capable of ex. in face of barriers) 6. Good & poor attenders differed significantly on perceptions of program & their involvement in program (Good attenders: more +, more successful, & achieved ex. goals). 7. SM non-sig. 8. Instructor influence contributed a sig. proportion of variance in program attendance.

Table 2. (Continued)

Key Findings of the Reviewed Studies

Author(s)	Design/Measures	Purpose	Results
McAuley, Wraith, & Duncan	- Cross-sectional - 10 weeks duration - Measures @ wk 10: 1. IM 2. SE (capable of ex. @ specific int, duration, f) 3. Perceptions of Success	1. To test Bandura's hypothesis that differing levels on SE have differential effects on IM. 2. To determine the degree to which perceptions of success & personal efficacy were related to IM for aerobic ex. activity.	1. Beginners < SE than Intermediate < SE than Advanced. Beginners & Intermediate did not differ significantly from each other, whereas advanced differed significantly from the other two. 2. IM: highly efficacious, ↑ IM, but the 3 ability groups did not differ significantly from each other. 3. SE & perceived success (self-evaluative mechanism) were sig. predictors of overall IM, however, perceived success accounted for more of the variance & SE served an augmenting function. 4. Perceptions of competence maximally contributed to the difference between high and low efficacy groups (highly efficacious individuals more intrinsically motivated & this
Rodgers & Sullivan	- Cross-sectional phone survey - 2 small pilot phone surveys - Random digit dialing process to fulfill 2 criteria: 1. = representation in 5 ex.B categories (based on f using ex. guidelines of regular ex. = 3x/wk & change process) 2. > 18 years of age - Measures: 1. SE (task, coping, & scheduling) Represent combinations of strength & magnitude dimensions of SE	To demonstrate differing ability of specific types of SE to discriminate among groups which vary according to ex. involvement. This would have implications from a theoretical perspective as well as for intervention	1. Main effect for f & different types of SE. 2. Multivariate difference between groups for task efficacy (unexpected) & for coping & scheduling efficacy (expected). 3. Coping & scheduling 3x more between group variance than task, therefore, better discriminators of ex. categories. 4. Exercisers: high task, coping, & scheduling efficacy. 5. Non-exercisers: high task, low coping & low scheduling efficacy, therefore, knowing how to do ex. is not a barrier, but ↓ ability to schedule & overcome other obstacles associated with ex. adherence. 6. Discriminant function analysis performed & the two items most strongly related to the between group differences were: a) scheduling ex. Regularly b) ex. when one feels one does not have time

Table 2. (Continued)

Key Findings of the Reviewed Studies

Author(s)	Design/Measures	Purpose	Results
Rodgers & Gauvin	- Cross-sectional - Using Maddux's 1986 adaptation of SET (Incentives Approach) - Pre- & post- design (5-6 wks into ex. program, 2nd ? mailed out) - Measures: 1. Incentives (OLxOV=OE) Primary Incentives (proximal outcomes) Secondary Incentives (distal outcomes) 2. SE: related to adherence to p.a. 3. Ex. B: self-reported f over 4 mos. 4. BI: with regards to f over next 3 mos	To examine whether persons who ex. 2x or </wk or 3x or > with intentions to maintain current level of activity form a homogenous group in terms of motivational features.	1. SE & Incentives discriminated highly active women from moderately active women. Highly active: SE maintained, higher incentives for mental health & stress reduction. Moderately active: unstable SE, SE ↓ significantly from the beginning of the ex, program to the 6th wk. 2. Similarities in terms of other incentives (appearance - primary & secondary, primary mental H outcomes, fitness (primary), & health (secondary). 3. Stages of change useful in describing motivational features of individuals in the process of adoption & maintenance of ex. (only for individuals exercising @ a high f (3xor >/wk)). 4. SE & incentives are individually insufficient to motivate B, one must be both efficacious & have the necessary incentives.
Rodgers & Brawley	- Cross-sectional - Pre- & post-test design 1. Incentives (OExOV) (Primary & Secondary) 2. BI 3. SE (wt. Training & attendance @ weekly training session)	1. To examine the use of SE & incentives in predicting BI to initiate wt lifters. Plausible that the likelihood & value of forthcoming outcomes should influence their future I, independent of their SE to learn about & to engage in the activity 2. To consider the proposed relationship at more time pts. than previous ex. studies (only pre-test of future B). 3. Hypothesized that incentives would predict BI just before novices initiated this new B while SE would be the dominant predictor shortly after gaining initial experiences.	1. Incentives played a role in the prediction of BI independent of SE. Therefore, when beginning a new experience, incentives influence future I. Once people have experience, SE would explain most of the variability in future I. 2. Primary incentives expected of post-clinic participation, independently predicted the variability in pre- & post-clinic future I beyond the variability predicted by SE. 3. Therefore, support for the impact of incentives & the joint influence of OE & SE on pa. 4. I ↓ for all participants. 5. Incentives & SE discriminated between individuals extreme in the strength of their I @ pre- & post-clinic. Although, individuals with low I can be confident in their ability to carry out the necessary actions, but just do not perceive any merit from doing so.

Table 2. (Continued)

Key Findings of the Reviewed Studies

Author(s)	Design/Measures	Purpose	Results
Rodgers & Brawley	- Cross-sectional (1 time only) Pilot for study 1: - Open-ended? (listing reasons for participating in pa) Study 1 Measures: 1. Importance 2. OL 3. OV Pilot for Study 2: - Open-ended? (listing why they participated & what outcomes might result from participating in a wt training program) Study 2 Measures: 1. Proximal Outcomes 2. Distal Outcomes	Study 1 & Study 2 - Primary? Was whether or not OL & OV (constructs of OE) were psychometrically useful relative to another type of measure typically used in PM research. Study 2 - Gender & activity controlled to examine OE of individuals engaged in a specific activity (proximal vs. distal outcomes - argued that proximal would have stronger OE ratings) Purpose: 1. To suggest a theoretically based approach for the examination of reasons for participation 2. To suggest a method of analysis based on this approach.	1. Support for OE in describing motives. 2. From study 2, proximal & distal outcomes differentiated (they do not have the same potential motivational role). 3. Distal outcomes were not as highly valued. 4. Therefore, conceptually, it is important to take into account not only the methodological issues but also participants' perceptions of why they participate & whether the measures used are meaningful in answering the ?.
Wilcox & Storandt	- Random digit telephone dialing - Measures: 1. Ex. Status 2. Demographics 3. SM 4. SE (rating confidence for increasingly difficult levels of ex.) 5. Att. (based on TRA)	To examine the differences between female exercisers & non-exercisers of varying ages on 3 psychological variables that are commonly studied correlates of ex. B: SE, SM, att toward ex.	1. SM: Age unrelated Exercisers > SM 2. SE: Age (-) related Higher proportion of variance than ex. Status Exercisers > SE 3. Att: Younger more (+) Exercisers more (+)

H = health; ? = questionnaire; Att. = attitude; B = behaviour; I = intention; HL of C = health locus of control; HB = health behaviour; SET = self-efficacy theory; BI = behavioural intention; SE = self-efficacy; Ex = exercise; Wks = weeks; SC = social cognitive; PA = physical activity; Wk = week; Sig. = significant; OE = outcome expectations; GXT = graded exercise test; SPAS = Social Physique Anxiety Scale; Tx = treatment; RA = random assignment; Non-sig. = non-significant; Mos = months; F = frequency; Int. = intensity; Mo = month; Pd. = period; RPE = Rate of Perceived Exertion; THR = Target Heart Rate; Ab = abdominal; FU = follow-up; SM = Self-Motivation; IM = Intrinsic Motivation; OL = Outcome Likelihood; OV = Outcome Value; Pts. = points; PM = Participation Motivation; vs = versus; TRA = Theory of Reasoned Action.

CHAPTER 3

METHODS AND PROCEDURES

Design of the Study *(Table 3; Figure 1)*

This study examined the changes in the psychological variables of attitude, self-efficacy and outcome expectations as part of a larger study involving a short-term high intensity exercise protocol with controlled energy intake. The larger study examined the relationship between EA and thyroid metabolism by altering energy intake and physical activity over a 3-day period. A mixed factorial design was utilized with one between subjects factor (energy availability) and several within subjects factors (attitudes, self-efficacy, outcome expectations) with repeated measures on the within subjects factors (pre-, during-, and post-exercise treatment). A 4 (EA group) x 4 (day: day 3, day 4, day 5, and day 6) between subjects ANOVA was employed for the indicators of attitude, self-efficacy and outcome expectations.

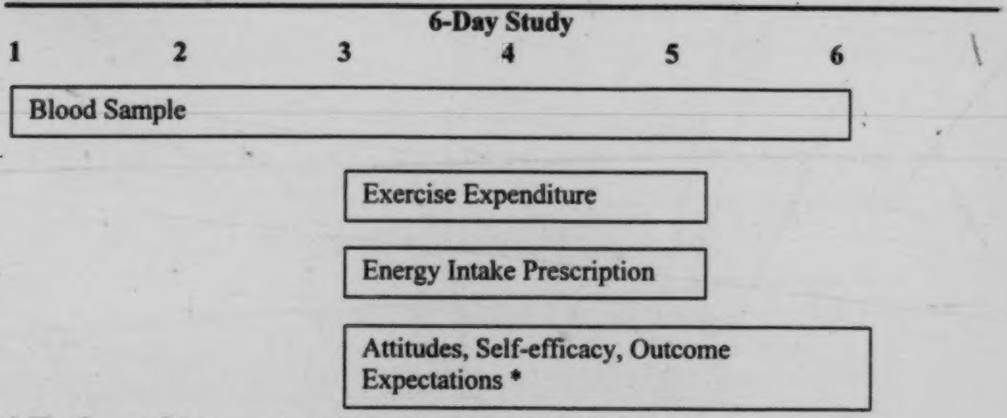
Women were randomly assigned into four groups of EA: 11, 19, 25, and 40 kcal/kg FFM/day. These four groups were designed to mimic the four groups created by Loucks and Heath (1994). Energy availability is the amount of energy consumed minus the amount of energy expended through physical activity (Loucks & Heath, 1994). Based on a study by Loucks and Heath (1994), EA was manipulated across four groups by controlling energy intake with a liquid nutritional supplement (Ensure, Ross Labs, Columbus, Ohio). In this study, the total energy expended for each participant was predetermined at approximately 25 kcal/kg FFM/day at an intensity just below VT. The study began on the first through seventh day of each participant's menstrual cycle and involved six consecutive days of coming to the Women's Health and Physical Activity

Lab at the University of Alberta. For six days, beginning two days prior to the exercise treatment, participants arrived first thing in the morning, between six and ten, after fasting since midnight to provide a 10-ml blood sample and determine body weight. On days 3, 4, and 5 of the experiment (exercise protocol), each woman completed a fixed volume of supervised exercise equivalent to 25kcal/kg FFM/day. The duration ranged from 2 hours 30 minutes to 3 hours 43 minutes of exercise each day depending on the participant's FFM and VT. The exercise was performed in 30-minute bouts with 10 minutes rest between bouts. In conjunction with the exercise, participants consumed a liquid nutritional supplement as their only food source. This liquid supplement was Ensure and contained 55% CHO, 30% fat, and 15% protein. Assigned energy values for the dietary intake were based on FFM and allotment of the liquid supplement was rounded to the nearest "Normal" can of Ensure. On days 3, 4, 5, and 6 of the study, questionnaires on attitudes, self-efficacy, and outcome expectations were completed after the blood sample was taken.

Table 3
Pre-Determined Values for Energy Availability, Fixed Energy Expenditure of Exercise and the Resulting Allotments of Caloric Intake

Group	N (20)	Dietary Intake (kcal/kg FFM/day)	Exercise Expenditure (kcal/kg FFM/day)	Energy Availability (kcal/kg FFM/day)
Blue	5	65	25	40
Green	5	50	25	25
Yellow	5	44	25	19
Red	5	36	25	11

Figure 1
6-Day Study


6-Day Study
1
2
3
4
5
6
Blood Sample
Exercise Expenditure
Energy Intake Prescription
Attitudes, Self-efficacy, Outcome Expectations *

* The focus of the current study was these psychological constructs

Participants

The participants for this study were overweight women volunteering from the University of Alberta and surrounding Edmonton community. In order to be included, the participants had to meet the following criteria (Appendix A): 18-40 years of age; non-smokers; weight stable (+/- 2 kg over the last two months); no oral contraceptive use; regular menstrual cycles for the previous 3 menstrual cycles prior to starting the study; overweight (BMI greater than 26); no reported medical conditions such as thyroid problems, heart disease, diabetes, eating disorders or depression (that could compromise hormonal status). This was established to obtain a homogenous sample thereby allowing inferences to the average healthy, overweight female population. Subsequently, a total of 20 women completed the study with five women in each condition.

Instruments

Attitudes *(Appendix B)*

Attitudes were measured in line with the recommendations of Ajzen and Timko (1986). Both evaluative and affective components were evaluated on 9-point semantic differential scales. The 5 items comprising the evaluative scale were "worthless/worthwhile; bad/good; foolish/wise; useless/useful; and harmful/beneficial". The 5 items that constituted the affective scale were " dull/interesting; aggravating/calming; unpleasant/pleasant; exhausting/invigorating; and boring/fun". For the four days that attitudes were measured (days 3, 4, 5 and 6), the internal consistency for evaluative attitudes varied from .83 to .94 and from .88 to .94 for affective attitudes.

Self-efficacy *(Appendix B)*

Based on Rodgers and Sullivan (in press), a self-efficacy scale was designed to understand participant's perceived confidence with regards to exercise under different situations. The questionnaire measured exercise self-efficacy based on a 100% confidence scale ranging from 0% (no confidence) to 100% (completely confident). Three subscales were used to measure self-efficacy: coping efficacy, task efficacy, and scheduling efficacy. Each question began with "How confident are you that you…" and ended with the items comprising the three types of efficacy. Three items assessed coping efficacy. These were "…you are tired/in a bad mood/ feel you don't have the time". Task efficacy was evaluated with four items: "…pace yourself to avoid over-exertion/perform all the required movements/ follow directions from an instructor/ check how hard your activity is making you work". Scheduling efficacy was measured by the following three items: "…overcome obstacles that prevent you from participating regularly/make up times you missed/exercise regularly, no matter what". For the present study, internal consistency was determined for each sub-scale for days 3, 4, 5 and 6 of the study. Alpha ranged from .67 to .85 for coping efficacy, .55 to .75 for task efficacy, and .82 to .88 for scheduling efficacy.

Outcome Expectations *(Appendix B)*

Outcome desirability and outcome likelihood were assessed based on questions developed in previous research addressing the exercise experience (Rodgers & Brawley, 1996; Rodgers & Gauvin, 1998). A 10-point Likert-type scale was developed with 1 being not at all likely or desirable and 10 being very likely or very desirable. Three scales comprised outcome expectations: during exercise, immediately after exercise and one or two days after exercise. Each scale ended with " how likely and desirable do you think it is that you would…". "Get sweaty/increase your heart rate/increase your breathing, breathe harder/feel exhilarated/feel exhausted/feel satisfied" made up the first scale. The second scale consisted of " feel more alert, awake/ feel more tired and worn out/ feel refreshed and alive/feel satisfied/feel more relaxed/feel less stressed and anxious". Lastly, the statements for the third scale were "feel good physically/feel generally happier, feel better emotionally/feel stiff, sore body/feel better about yourself, more confident/have more energy/be more tired/ feel less stressed and anxious/feel satisfied". For the purposes of this study, each item was analyzed on its own; therefore, no internal consistency analyses were performed.

Method and Procedures

Participants responding to posters *(Appendix C)* located around the university campus and various fitness facilities; advertisements on the graduate students association (GSA) e-mail, the Edmonton Journal and the local television community events; and announcements in fitness classes and university courses were recruited. Once participants phoned or e-mailed their interest, a telephone interview was conducted. If entry criteria were met, the study protocol and time commitment were explained. An appointment was made for each participant to come in and receive details regarding the study and provide demographic information.

When each participant met with the researcher, a detailed explanation of the study was given as well as a written explanation of the study. Informed consent was obtained at this time *(Appendix D)*, and two questionnaires were completed: a demographic questionnaire *(Appendix E)* that examined health status, menstrual cycles, physical activity patterns, and participant availability; and a Par-Q *(Appendix F)*.

Measurement Protocols

1. Aerobic Fitness Assessment *(Appendix G)*

Each participant's VO_{2max} was determined using an incremental protocol on a Monarch cycle ergometer (Varberg, Sweden). Before getting on the cycle ergometer, height and weight were recorded. Each participant was then fitted with a Polar heart rate monitor (Polar Electro Heart Rate Monitor, Polar USA Inc, Stanford, Connecticut). Participants started with a resistance of 1.0 kp and pedaled at a cadence ranging from 50 - 60 rpms with the rpms remaining constant for the duration of the test. Resistance was increased 0.5kp every 2 minutes until VT was identified by a decrease and plateau in

VE/VCO_2 prior to a systematic increase with increased power output as well as a RER greater than 1.05 (Bhambhani et al, 1985). Following VT determination, resistance was increased 0.5kp every one minute to volitional exhaustion. Gases were analyzed every 20 seconds utilizing standard open circuit spirometry (SensorMedics Horizon Metabolic Cart, Anaheim, California). Heart rate was recorded every minute using a heart rate monitor. Criteria for establishing peak VO_{2max} included two of the following criteria: 1) RER ratio (the ratio of VCO_2 to VO_2) greater than 1.1; 2) volitional exhaustion; and 3) . HR_{max} within 5 beats of their age-predicted maximum heart rate.

2. Body Composition *(Appendix H)*

This was assessed through hydrostatic weighing on either day 1 or 2 of the study prior to beginning the 3-day treatment phase of the study. Participants were instructed to eat nothing by mouth for four hours before the test as well as to refrain from exercising until after the test. Height and weight were recorded before residual lung volume measurement using the helium dilution technique (Motley, 1957). Body density was then used to calculate FFM, FM, and % body fat. This was performed by weighing each participant underwater with water temperature and trapped air (i.e. residual lung volume and gastrointestinal tract volume) corrected for each participant. Six to ten trials were done and the average of the closest trials was used for the study. Percentage body fat from body density was calculated using the formula of Siri (1956).

3. Habitual 7-Day Dietary Intake *(Appendix I)*

A 7-day diet record was given to each participant to determine habitual food intake. All details of food consumption were recorded in the booklet provided and participants were trained by the researcher on how to complete it. The diet record was to be completed before entering the 6-day study; however, due to time constraints some participants completed the diet record after completion of the study. One participant failed to bring her diet record in. Diet records were analyzed using the Food Processor II computer software program (ESHA Research, Oregon). The mean caloric, CHO, fat, and protein intake (grams and % of total daily energy intake) were calculated for each participant.

Treatment Variables

1. Group Assignment

Random assignment was performed when a participant began the 6-day study. The four group colors representing the different energy availabilities were written on a piece of paper and placed in a box. One color was then randomly drawn determining the participant's energy availability group. This color would then be removed until every color had been chosen. All four colors would then be placed back in the box and the process repeated. This process ensured that participants were assigned to each of the groups at approximately the same rate as well as an equal distribution across the groups.

2. Start Date

Once the participant's menses began, she contacted the researcher and the 6-day study began with day six of the menstrual cycle being the latest possible start day. Fat free mass was used in calculating energy intake and the total exercise duration for the subject. VT was used to determine exercise intensity.

3. Dietary Intake (3-Day Treatment)

Cans of Ensure (Ross Laboratories, Columbus, Ohio) were given to the participants and the amount varied depending on FFM and the EA group that they were in. "Normal" and "Plus" cans were given with the "Normal" containing 250 kcal and the "Plus" containing 355 kcal. Participants had their choice of chocolate, strawberry, vanilla and wildberry. Each drink contained 55% CHO, 30% fat, and 15% protein. Participants were instructed to have their cans ingested by midnight and told not to consume other foods or liquids except water. Compliance with the diet was tested through a series of questions asked first thing in the morning (days 4, 5, and 6):

1) Have you fasted since midnight?
2) Did you consume all of your liquid nutritional supplement yesterday?
3) Did you consume anything else besides your liquid nutritional supplement yesterday?
4) Did you exercise outside of the lab yesterday? (If yes, what did you do?)

On the days prior to the dietary intake (Days 1, 2, and 3), the questions differed slightly:

1) Have you fasted since midnight?
2) Did you consume your usual amount of food and beverages yesterday? (If no, please explain).
3) Did you exercise yesterday? (If yes, what did you do?)

All participants followed their normal routine prior to the treatment days and all were compliant during the treatment portion of the study. The labels were removed from the cans of Ensure so the brand of the drink and the number of calories were kept confidential. This was done to keep the participants blind to the treatment condition that they were in. Participants did not know that there were "Normal" and "Plus" cans. If they knew how many calories they were consuming, they may have been tempted to consume more calories if they were only consuming a small amount of calories per day or drink less if they felt they were taking in too many calories. To distinguish between "Normal" and "Plus" and the different types of flavor labels were removed, the flavors were marked in red pen indicating a "Plus" flavor and all other colors represented "Normal" flavors.

4. Exercise (3-Day Treatment) *(Appendix J)*

Based on peak VO_2 (as described earlier) VT was determined. Most participants exercised at 90% of their VT; however due to poor fitness levels, the intensity was reduced to 80% for several participants, and 70% for one, resulting in a longer duration of exercise. Total energy expenditure was equivalent to 25 kcal/kg FFM/day on a Monarch bicycle. Under continuous supervision, each participant rode for 30-minute bouts separated by a ten-minute break. The average time on the bike was 3 hours 2 minutes excluding breaks. While riding, HR, resistance and rpms were recorded every five minutes. As well, throughout minutes 5 to 10 of every other exercise bout (i.e. exercise bouts 1, 3, 5, and possibly 7 depending on total duration), oxygen uptake was measured directly using open circuit spirometry, ensuring that the proper intensity was maintained. To help pass the time while exercising, participants were allowed to watch movies, although the first two thirty minute bouts were movie free to capture the exercise experience without distractions.

5. Blood Sampling and Questionnaires

Upon arrival at the lab for the first day of treatment, a blood sample was drawn. On day two, a blood analysis was performed again, but no questionnaires were given. On days three to six, after the blood sample, a questionnaire on attitudes, self-efficacy and outcome expectations was filled out with the first day being a baseline before exercise and the last day being a post study questionnaire. On days 3-5, after filling out the questionnaire, participants put on a HR monitor and proceeded to cycle on a stationary Monarch bike at the predetermined workload. On the last day of the study, day 6, following the blood analysis, the questionnaire on attitudes, self-efficacy, and outcome expectations was completed for the last time. No exercise took place on day six, therefore this was a post study questionnaire, to capture the psychological effects of the exercise experience the day before.

CHAPTER 4

RESULTS

Physiological Information

1. Demographic Profile of Participants *(Table 4)*

Twenty, healthy overweight females completed this study. None of the participants reported reproductive problems or any complications with regards to reproductive or metabolic hormones. Only five of the twenty were sedentary, while the remaining fifteen were active on a regular basis.

There was no statistical difference in age between the groups. The mean age of participants was 31.1 years with a range in age from 18 to 40 years of age. As can be seen from the means in Table 4, one way ANOVAs found that participants in all four conditions were not significantly different from each other with respect to height, weight, BMI, % body fat, FFM, and FM. The mean height and weight of participants were 165.5 cm and 86.8 kg respectively. A BMI of greater than 26 was one of the criteria for entry into the study and ranged from 25.7 to 46.1 with a mean of 31.6. Underwater weighing was conducted to determine participants' % body fat, FFM, and FM. Mean body fat was 39.2%; mean FFM was 51.6 kg; and mean FM was 34.6 kg.

Table 4
Demographic Characteristics Between Groups (Mean, (Standard Deviation), Range) (n=5/EA)

		All Groups Combined	Blue (EA40)	Green (EA25)	Yellow (EA19)	Red (EA11)
Age	Mean	31.1	32.0	30.6	32.6	29.0
	(SD)	(7.2)	(7.6)	(8.0)	(5.6)	(9.0)
	Range	18-40				
Height (cm)	Mean	165.5	164.3	166.6	166.2	165.0
	(SD)	(6.3)	(7.3)	(2.9)	(6.7)	(8.8)
	Range	156.7-179.4				
Weight (kg)	Mean	86.8	86.3	93.4	92.2	75.2
	(SD)	(16.1)	(12.4)	(16.5)	(22.7)	(5.5)
	Range	65.0-122.5				
BMI	Mean	31.6	31.7	33.6	33.4	27.7
	(SD)	(5.2)	(2.5)	(5.2)	(8.0)	(2.3)
	Range	25.7-46.1				
Body Fat (%)	Mean	39.2	42.6	42.0	39.4	32.9
	(SD)	(7.3)	(4.3)	(5.1)	(9.2)	(7.3)
	Range	25.3-53.7				
FFM (kg)	Mean	51.6	48.6	53.1	54.4	50.1
	(SD)	(6.1)	(3.9)	(6.3)	(8.0)	(5.8)
	Range	41.5-62.2				
FM (kg)	Mean	34.6	36.8	39.6	37.5	24.7
	(SD)	(12.4)	(8.9)	(11.4)	(17.8)	(6.0)
	Range	18.1-65.4				

2. Aerobic Assessment *(Table 5)*

A VO_{2max} test was conducted on a stationary Monarch bike. From this, VO_{2max}, HR_{max}, and VT were determined. No differences between groups were found. Relative VO_{2max} had a mean value of 30.2 ml/kg/min while absolute $VO2_{max}$ had a mean value of 2.57 L/min. Maximum heart rates went from 155 bpm up to 209 bpm with a mean of 181.4 bpm. Ventilatory threshold relative to body weight had a group mean of 19.9 ml/kg/min and absolute VT had a group mean of 1.7 L/min.

Table 5

Maximal Oxygen Consumption (VO_{2max}), Ventilatory Threshold, and HR_{max} (Mean, (SD), and Range) (n=5/EA)

		All Groups Combined	EA40	EA25	EA19	EA11
VO_{2max} (ml/kg/min)	Mean	30.2	28.1	29.1	28.6	35.0
	(SD)	(6.6)	(3.8)	(7.2)	(5.0)	(8.7)
	Range	21.0-44.2				
VO_{2max} (L/min)	Mean	2.6	2.4	2.7	2.6	2.6
	(SD)	(0.39)	(0.4)	(0.3)	(0.3)	(0.6)
	Range	1.73-3.19				
HR_{rmax} (bpm)	Mean	181.4	181.2	186.2	177.2	181.0
	(SD)	(15.7)	(15.9)	(14.8)	(17.2)	(18.9)
	Range	155-209				
VT (ml/kg/min)	Mean	19.9	19.2	20.0	19.2	21.0
	(SD)	(3. 5)	(3.7)	(5.1)	(3.0)	(2.4)
	Range	14.2-26.0				
VT (L/min)	Mean	1.7	1.6	1.8	1.7	1.6
	(SD)	(0.2)	(0.2)	(0.2)	(0.3)	(0.2)
	Range	1.2-2.0				

3. Habitual 7-Day Dietary Intake *(Table 6)*

There were no significant differences between groups with regards to habitual caloric intake although the number of calories consumed ranged 1604 to 3672 kcal/day with an overall mean of 2242 kcal/day. No significant findings were found for CHO, protein, and fat intake between groups in grams or as a percentage of total calories. Collapsed group means were 303.9 g/day and 54.9% for CHO; 85.0 g/day and 15.7% for protein; and 72.3 g/day and 28.8% for fat.

Table 6
Habitual 7-Day Dietary Intake (Mean, (SD), and Range) (n=5/EA)

	All Groups Combined	EA40	EA25	EA19	EA11
Caloric Intake (kcal/day)	2241 (427) 1604-3572	2085 (463)	2189 (283)	2462 (745)	2273 (158)
CHO intake (grams/day)	303.9 (69.5) 158.8-420.9	269.2 (34.4)	279.4 (86.4)	356.3 (53.2)	321.1 (74.8)
CHO intake (% of total calories)	54.9 (9.2) 37.0-71.0	51.6 (6.8)	49.8 (11.5)	59.8 (8.8)	59.4 (6.9)
Pro intake (grams/day)	85.0 (18.5) 56.7-125.1	77.4 (11.7)	96.0 (20.4)	89.9 (21.5)	77.8 (18.3)
Pro intake (% of total calories)	15.7 (2.9) 10.0-22.0	15.2 (1.6)	17.4 (3.4)	15.0 (1.8)	15.2 (4.0)
Fat intake (grams/day)	72.3 (29.1) 30.8-136.8	80.2 (35.6)	75.9 (18.7)	72.5 (44.2)	60.5 (21.4)
Fat intake (% of total calories)	28.8 (8.1) 13.0-46.0	32.8 (8.1)	31.2 (7.9)	25.5 (9.5)	25.2 (6.7)

4. Dietary Intake (3-day treatment) *(Table 7)*

The number of calories consumed by participants during the study ranged from 1605 kcal/day (i.e. participant in EA11) to 3590 kcal/day (i.e. participant in EA40). Post hoc tests found that EA40 was significantly different than EA19 and EA11; EA25 was significantly different than EA11; EA19 was significantly different than EA40 and EA11; and EA11 was significantly different from all the groups. These are consistent with the energy availability assignments allocated to each group.

5. Difference in Energy Intake Between 7-Day Habitual and 3-Day Treatment (3-Day- 7-Day) *(Table 7)*

The mean difference between the 7-day habitual and the 3-day treatment was 316 calories extra consumed during the 3-day treatment with EA25 taking the most extra calories in during the treatment, 476 kcal compared to the 7-day habitual. The EA11 group consumed the least amount of calories compared to their 7-day habitual with 412 fewer kcal consumed during the study.

6. Body Weight Change (Baseline to Post-Treatment) *(Table 7)*

Change in body weight ranged from a gain of .80 kg (participant in EA25) to a loss of 2.80 kg (participant in EA40), which, was unusual considering that the participants in EA40 were in the highest energy availability group and were therefore consuming more calories. There were however no statistical differences between groups.

Table 7
Dietary Intake (3-Day Treatment)/Difference in Energy Intake Between 7-Day Habitual and 3-Day Treatment/Body Weight Changes From Baseline to Post-Treatment (Mean, (SD), Range) (n=5/EA)

	All Groups Combined	EA40	EA25	EA19	EA11	p value
Dietary Intake (kcal/day)	2557 (531) 1605-3590	3156 (247)	2665 (327)	2407 (311)	1861 (102)	$.000_{abcd}$
Energy Difference (3-Day-7-Day)	316	107	476	-55	-412	
Body weight changes (Mean=Day6 – 1, 2, 3/3)	-.9 (+/-1.0) (.8)-(-2.8)	-.5 (+/-1.4)	-.3 (+/-.7)	-1.2 (+/-.9)	-1.6 (+/-.7)	-.2

a=EA40 significantly different than EA19 and EA11
b=EA25 significantly different than EA11
c=EA19 significantly different than EA40 and EA11
d=EA11 significantly different than all

Psychological Correlates

A 4 (group: EA40, EA25, EA19, EA11) x 4 (day: d3, d4, d5, d6) mixed-model ANOVA with repeated measures on the second factor was performed on attitudes, self-efficacy (coping, task, and scheduling efficacy), and outcome expectations.

Attitudes

1. Evaluative Attitudes *(Table 8)*

Means and standard deviations for evaluative attitudes are presented in Table 8. No main effects were found for day F (3,12) = 1.66, p = .23 ($eta^2 = .29$); group F (3,14) = 2.25, p = .13 ($eta^2 = .33$); or day X group F (3,14) = .99, p = .47 ($eta^2 = .19$).

Table 8
Means (Standard Deviations) for Evaluative Attitudes Between Groups Across Time.

	Energy Availability (kcal/kg FFM/d) (n=5/EA)				
	EA40	EA25	EA19	EA11	All EA Groups
Day 3	7.68 (1.19)	9.00 (0)	8.87 (.23)	8.56 (.52)	8.49 (.84)
Day 4	7.84 (1.31)	9.00 (0)	9.00 (0)	8.16 (1.55)	8.44 (1.12)
Day 5	8.12 (.87)	9.00 (0)	8.93 (.12)	7.56 (2.27)	8.34 (1.33)
Day 6	8.52 (.66)	9.00 (0)	8.93 (.12)	8.96 (.09)	8.84 (.39)

2. Affective Attitudes (Table 9)

Means and standard deviations for affective attitudes are presented in Table 9. No main effects were found for day F (3,12) = 1.01, p = .42 ($eta^2 = .20$); group F (3,14) = .21, p = .89 ($eta^2 = .04$); or day X group F (3,14) = 1.33, p = .26 ($eta^2 = .24$).

Table 9
Means (Standard Deviations) for Affective Attitudes Between Groups Across Time.

	Energy Availability (n=5/EA)				
	EA40	EA25	EA19	EA11	All EA Groups
Day 3	6.16 (2.20)	7.28 (.63)	7.00 (1.44)	7.44 (.89)	6.97 (1.39)
Day 4	6.88 (1.67)	6.68 (1.04)	7.87 (.70)	7.28 (1.27)	7.10 (1.24)
Day 5	7.04 (1.49)	6.60 (1.05)	7.33 (1.21)	6.32 (2.06)	6.77 (1.45)
Day 6	7.20 (1.62)	6.72 (1.44)	7.67 (1.03)	7.20 (1.10)	7.14 (1.27)

Self-Efficacy

1. Coping Efficacy *(Table 10)*

Means and standard deviations for coping efficacy between groups across time are presented in Table 10. No main effects for day F (3,14) = 2.77, p = .08 (eta^2 = .37)) or group F (3,16) = .25, p=.86 (eta^2 = .05). Furthermore, there was no day X group interaction F (3,16) = 0.92, p = .52 (eta^2 = .16).

Table 10
Means (Standard Deviations) for Coping Efficacy Between Groups Across Time.

	Energy Availability (n=5/EA)				
	EA40	EA25	EA19	EA11	All EA Groups
Day 3	50.66 (13.20)	70.00 (7.45)	55.33 (18.94)	61.00 (25.16)	59.25 (17.66)
Day 4	66.00 (6.41)	66.67 (14.91)	68.00 (24.79)	75.67 (18.24)	69.08 (16.45)
Day 5	74.00 (11.58)	67.20 (18.42)	67.60 (19.57)	77.20 (14.75)	71.50 (15.66)
Day 6	74.00 (11.88)	69.00 (19.78)	68.00 (22.80)	76.67 (19.00)	71.92 (17.63)

2. Task Efficacy *(Table 11)*

Means and standard deviations for task efficacy across group and time are presented in Table 11. There were no main effects for day F (3,14) = 2.95, p = .07 (eta^2 = .39) or group F (3,16) = .97, p = .43 (eta^2 = .12). The day X group interaction was also not significant F (3,16) = .68, p = .73 (eta^2 = .12).

Table 11
Means (Standard Deviations) for Task Efficacy Between Groups Across Time.

	Energy Availability (n=5/EA)				
	EA40	EA25	EA19	EA11	All EA Groups
Day 3	87.50 (11.73)	85.00 (3.54)	81.00 (7.62)	83.75 (3.95)	84.31 (7.27)
Day 4	92.50 (7.07)	86.00 (6.28)	85.50 (3.71)	90.50 (4.47)	88.63 (5.93)
Day 5	93.00 (7.37)	85.75 (8.82)	90.50 (6.22)	89.25 (5.70)	89.63 (7.07)
Day 6	93.00 (7.79)	87.00 (8.91)	88.00 (5.42)	88.75 (7.40)	89.18 (7.26)

3. Scheduling Efficacy *(Table 12)*

Means and standard deviations for scheduling efficacy are presented in Table 12. There were no main effects for day F (3,14) = .16, p = .92 (eta^2 = .03) and there was no day X group interaction F (3,16) = 1.10, p = .39 (eta^2 = .19), but a main effect for group was found F (3,16) = 4.17, p = .023 (eta^2 = .439). Post hoc tukey tests showed that EA25 (the second highest energy intake group) had significantly higher scheduling efficacy then EA40 and EA19; however, EA40, EA19, and EA11 had similar scheduling efficacy.

Table 12
Means (Standard Deviations) for Scheduling Efficacy Between Groups Across Time.

	Energy Availability (n=5/EA)					
	EA40	EA25	EA19	EA11	All EA Groups	p value
Day 3	58.67 (12.16)	92.00 (4.47)	68.00 (22.56)	83.33 (14.34)	75.50 (19.05)	.02$_b$
Day 4	69.33 (10.11)	86.33 (5.82)	68.00 (15.20)	78.33 (19.72)	75.50 (14.73)	
Day 5	70.00 (9.13)	88.67 (5.58)	65.33 (17.89)	81.33 (13.86)	76.33 (14.86)	
Day 6	68.00 (15.92)	89.33 (5.48)	62.67 (18.62)	82.00 (9.89)	75.50 (16.52)	

b=EA25 significantly higher than EA40, EA19, and EA11

Outcome Expectations

Outcome During Exercise *(Items 1 – 6)*

1. Get Sweaty *(Table 13)*

Means and standard deviations for outcome likelihood (OL) and outcome desirability (OD), item one, get sweaty, are given in Table 13. For OL, no main effects were found for day F (3,14) = .441, p = .727 (eta^2 = .09); group F (3,16) = .78, p = .524 (eta^2 = .127); or day X group F (3,16) = 4.0, p = .210 (eta^2 = .23). No main effects were found for OD as well. For day, F (3,14) = 1.15, p = .36 (eta^2 = .198); for group F (3, 16) = .01, p = 1.0 (eta^2 = .002); and for the day X group interaction F (3,16) = .855 p = .57 (eta^2 .15).

Table 13

Means (Standard Deviations) for Outcome Expectations (OL & OD) During Exercise. (Get Sweaty: Item 1)

		Energy Availability (n=5/EA)									
		EA40		EA25		EA19		EA11		All EA Groups	
		OL	OD	OL	OD	OL	OD	OL	OD	OL	OD
Day 3	Mean	8.60	7.20	10.00	6.80	9.60	8.20	9.25	7.40	9.25	7.40
	(SD)	(2.61)	(3.11)	(0)	(3.70)	(.55)	(2.17)	(2.17)	(1.95)	(1.68)	(2.64)
Day 4	Mean	8.80	7.00	9.60	7.00	9.80	6.40	8.60	7.20	9.20	6.90
	(SD)	(1.30)	(3.32)	(.89)	(3.16)	(.45)	(4.51)	(2.61)	(2.17)	(1.51)	(3.13)
Day 5	Mean	9.20	8.00	9.60	9.00	9.80	7.00	8.40	7.20	9.25	7.80
	(SD)	(1.10)	(2.83)	(.89)	(2.12)	(.45)	(3.94)	(2.51)	(2.77)	(1.45)	(2.86)
Day 6	Mean	9.00	7.60	9.60	6.60	9.80	7.00	8.80	7.60	9.30	7.20
	(SD)	(1.22)	(3.21)	(.89)	(3.78)	(.45)	(3.94)	(2.17)	(2.51)	(1.30)	(3.16)

2. Increase Your Heart Rate *(Table 14)*

Means and standard deviations for item 2, increase your heart rate, are presented in Table 14. For OL, no main effects were found for day F (3,14) = .087, p = .97 (eta^2 = .018); group F (3,16) = .31, p = .82 (eta^2 = .06); or for the day X group interaction F (3,16) = 1.67, p = .80 (eta^2 = .11). For OD, no main effects were found for day F (3,14) = 3.15, p = .06 (eta^2 = .40); group F (3,16) = .76, p = .53 (eta^2 = .13); or day X group F (3,16) = 3.11, p = .453 (eta^2 = .17).

Table 14
Means (Standard Deviations) for Outcome Expectations (OL and OD) During Exercise. (Increase Your Heart Rate: Item 2)

		Energy Availability (n=5/EA)									
		EA40		EA25		EA19		EA11		All EA Groups	
		OL	OD	OL	OD	OL	OD	OL	OD	OL	OD
Day 3	Mean	9.60	9.80	9.60	9.20	9.60	10.00	10.00	10.00	9.70	9.75
	(SD)	(.89)	(.45)	(.89)	(1.10)	(.55)	(0)	(0)	(0)	(.66)	(.64)
Day 4	Mean	9.60	9.20	9.20	8.60	9.80	9.00	9.80	9.80	9.60	9.15
	(SD)	(.89)	(1.10)	(1.10)	(1.95)	(.45)	(1.73)	(.45)	(.45)	(.75)	(1.39)
Day 5	Mean	9.60	7.80	9.40	9.20	9.80	9.80	9.60	9.00	9.60	8.95
	(SD)	(.89)	(2.59)	(.89)	(1.10)	(.45)	(.45)	(.55)	(1.22)	(.68)	(1.61)
Day 6	Mean	9.60	8.40	9.60	8.60	9.80	9.80	9.60	9.20	9.65	9.00
	(SD)	(.89)	(1.67)	(.89)	(2.19)	(.45)	(.45)	(.89)	(1.3)	(.75)	(1.52)

3. Increase Your Breathing/Breathe Harder *(Table 15)*

Means and standard deviations for item 3 are presented in Table 15. For OL, no main effects were found for day F (3,14) = .39, p = .76 (eta^2 = .08) or group F (3,16) = .495, p = .691 (eta^2 = .09); or day X group F (3,16) = 1.43, p = .22 (eta^2 = .23). For OD, no main effects were found for day F (3,14) = .06, p = .98 (eta^2 = .01); group F (3,16) = .26, p = .85 (eta^2 = .05); or day X group F (3.16) = 1.40, p = .23 (eta^2 = .22).

Table 15
Means (Standard Deviations) for Outcome Expectations (OL and OD) During Exercise. (Increase Your Breathing/Breathe Harder: Item 3)

		Energy Availability (n=5/EA)									
		EA40		EA25		EA19		EA11		All EA Groups	
		OL	OD	OL	OD	OL	OD	OL	OD	OL	OD
Day 3	Mean	9.00	8.80	9.60	8.40	9.60	8.60	9.80	9.60	9.50	8.85
	(SD)	(1.00)	(1.30)	(.89)	(2.30)	(.55)	(2.07)	(.45)	(.55)	(.76)	(1.63)
Day 4	Mean	9.40	8.80	9.20	8.60	9.80	8.80	9.80	8.80	9.55	8.75
	(SD)	(.89)	(1.30)	(1.30)	(1.95)	(.45)	(2.17)	(.45)	(1.10)	(.83)	(1.55)
Day 5	Mean	8.80	7.60	9.60	9.20	9.80	9.00	9.60	9.00	9.45	8.70
	(SD)	(1.79)	(2.88)	(.89)	(1.10)	(.45)	(1.73)	(.55)	(1.22)	(1.05)	(1.84)
Day 6	Mean	9.60	7.80	9.60	9.20	9.60	9.00	9.60	9.00	9.60	8.75
	(SD)	(.89)	(2.17)	(.89)	(1.10)	(.55)	(1.73)	(.89)	(1.73)	(.75)	(1.68)

4. Feel Exhilarated *(Table 16)*

Means and standard deviations for this item are presented in Table 16. No mean effects for OL were found for day F (3,14) = 2.66, p = .09 (eta^2 = .36); group F (3,16) = 2.35, p = .11 (eta^2 = .31); or day X group F (3,16) = 1.97, p = .07 (eta^2 = .29). For OD, no main effects were found for day (3,14) = 2.83, p = .08 (eta^2 = .38); group F (1,16) = 1.54, p = .24 (eta^2 = .22); or day X group F (3,16) = 1.31, p = .27 (eta^2 = .21).

Table 16
Means (Standard Deviations) for Outcome Expectations (OL and OD) During Exercise. (Feel Exhilarated: Item 4)

		Energy Availability (n=5/EA)									
		EA40		EA25		EA19		EA11		All EA Groups	
		OL	OD	OL	OD	OL	OD	OL	OD	OL	OD
Day 3	Mean	7.80	9.60	8.60	9.80	9.20	9.60	9.20	10.00	8.70	9.75
	(SD)	(1.48)	(.89)	(.89)	(.45)	(1.10)	(.55)	(.84)	(0)	(1.17)	(.55)
Day 4	Mean	8.20	9.40	6.80	8.80	8.40	9.60	8.60	9.30	8.00	9.28
	(SD)	(1.30)	(.89)	(1.10)	(1.30)	(.55)	(.55)	(1.14)	(.67)	(1.21)	(.88)
Day 5	Mean	8.00	9.40	7.20	8.40	7.20	9.80	8.60	9.60	7.75	9.30
	(SD)	(1.58)	(.89)	(.84)	(1.14)	(2.39)	(.45)	(1.14)	(.89)	(1.59)	(.98)
Day 6	Mean	8.40	9.60	6.00	8.60	7.20	9.60	8.80	9.80	7.60	9.40
	(SD)	(1.34)	(.55)	(1.41)	(1.52)	(1.48)	(.55)	(1.30)	(.94)	(1.70)	(.94)

5. Feel Exhausted *(Table 17)*

Means and standard deviations for feel exhausted are in Table 17. No main effect was found on OL for day F (3,14) = 2.04, p = .15 (eta^2 = .30); group F (3,16) = .65, p = .59 (eta^2 = .11); or day X group F (3,16) = .74, p = .67 (eta^2 = .14). No main effects were found on OD for day F (3,14) = 3.04, p = .06 (eta^2 = .39); group F (3,16) = .25, p = .86 (eta^2 = .05); or day X group F (3,16) = .74, p = .67 (eta^2 = .13).

Table 17

Means (Standard Deviations) for Outcome Expectations (OL and OD) During Exercise. (Feel Exhausted: Item 5)

		Energy Availability (n=5/EA)									
		EA40		EA25		EA19		EA11		All EA Groups	
		OL	OD	OL	OD	OL	OD	OL	OD	OL	OD
Day 3	Mean	6.40	3.80	6.40	3.60	7.00	5.40	5.00	3.40	6.20	4.05
	(SD)	(2.88)	(3.56)	(2.97)	(2.41)	(1.58)	(3.65)	(1.87)	(1.34)	(2.33)	(2.78)
Day 4	Mean	5.40	4.00	6.20	3.20	7.20	4.80	5.00	2.40	5.95	3.60
	(SD)	(3.36)	(3.74)	(2.86)	(3.03)	(2.28)	(2.95)	(2.00)	(2.61)	(2.61)	(3.00)
Day 5	Mean	3.60	2.40	6.00	1.60	5.40	2.00	4.80	3.00	4.95	2.25
	(SD)	(2.30)	(1.67)	(2.55)	(.89)	(1.82)	(1.00)	(1.79)	(2.00)	(2.16)	(1.45)
Day 6	Mean	5.00	3.20	6.80	1.20	5.60	1.60	4.60	3.00	5.50	2.25
	(SD)	(3.32)	(3.90)	(2.77)	(.45)	(2.07)	(.55)	(2.07)	(3.08)	(2.54)	(2.47)

6. Feel Satisfied *(Table 18)*

Means and standard deviations for feel satisfied are presented in Table 18. For OL, no mean effects were found for day F (3,14) = 1.95, p = .17 (eta^2 = .29); group F (3,16) = .19, p = .90 (eta^2 = .03); or day X group F (3,16) = .74, p = .67 (eta^2 = .13). For OD, no main effects were found for group F (3,16) = .86, p = .48 (eta^2 = .14) or day X group F (3,16) = 1.27, p = .29 (eta^2 = .21). However, a main effect was found for day F (3,14) = 3.38, p = .048 (eta^2 = .42). Post hoc tukey tests were conducted, but they did not show any significant differences between groups.

Table 18

Means (Standard Deviations) for Outcome Expectations (OL and OD) During Exercise. (Feel Satisfied: Item 6)

	Energy Availability (n=5/EA)										
	EA40		EA25		EA19		EA11		All EA Groups		
	OL	OD	OL	OD	OL	OD	OL	OD	OL	OD	p value
Day 3	8.60 (.89)	10.00 (0)	8.40 (1.52)	10.00 (0)	9.00 (.71)	10.00 (0)	9.00 (1.22)	9.60 (.55)	8.75 (1.07)	9.90 (.31)	$.05_{day}$
Day 4	8.40 (1.14)	9.60 (.55)	7.80 (.84)	9.60 (.55)	8.40 (.89)	9.60 (.55)	8.60 (1.52)	9.60 (.55)	8.30 (1.08)	9.60 (.50)	
Day 5	8.00 (1.22)	9.80 (.45)	8.20 (1.10)	9.40 (.89)	8.20 (1.10)	10.00 (0)	8.40 (1.52)	9.80 (.45)	8.20 (1.15)	9.75 (.55)	
Day 6	8.6 (1.14)	10.0 (0)	8.0 (1.22)	9.4 (.89)	8.6 (1.14)	9.8 (.45)	8.0 (1.58)	9.8 (.45)	8.3 (1.22)	9.75 (.55)	

Day = main effect for OD found, however, post hoc tests found no significant differences between groups

Outcomes Immediately After Exercise *(Items 7-12)*

7. Feel More Alert/Awake *(Table 19)*

Means and standard deviations for item 7 are presented in Table 19. For OL, No main effects were found for day F (3,14) =1.96, p = .17 (eta^2 = .30); group F (3,16) = 1.1, p = .38 (eta^2 = .17); or day X group F (3,16) = .32, p = .96 (eta^2 = .06). For OD, no main effects were found for day F (3,14) = .94, p = .45 (eta^2 = .17); group F (3,16) = 1.56, p = .24 (eta^2 = .23); or day X group F (3,16) = .79, p = .63 (eta^2 = .14).

Table 19

Means (Standard Deviations) for Outcome Expectations (OL and OD) Immediately After Exercise.(Feel More Alert/ Awake: Item 7)

Energy Availability (n=5/EA)

		EA40		EA25		EA19		EA11		All EA Groups	
		OL	OD	OL	OD	OL	OD	OL	OD	OL	OD
Day 3	Mean	9.00	2.00	8.00	1.80	8.80	1.20	9.40	1.40	8.80	1.60
	(SD)	(1.22)	(1.73)	(2.12)	(.84)	(1.30)	(.45)	(.89)	(.89)	(1.44)	(1.05)
Day 4	Mean	8.80	2.00	7.40	1.20	8.00	1.60	8.80	2.00	8.25	1.70
	(SD)	(1.30)	(1.73)	(2.79)	(.45)	(2.92)	(2.19)	(.84)	(1.34)	(2.07)	(1.85)
Day 5	Mean	8.60	3.60	7.20	1.20	7.20	2.40	8.60	2.60	7.90	2.45
	(SD)	(1.14)	(2.41)	(1.92)	(.45)	(3.56)	(2.19)	(1.34)	(1.34)	(2.15)	(1.85)
Day 6	Mean	8.80	3.20	6.60	1.00	7.00	1.20	8.40	2.80	7.70	2.05
	(SD)	(.84)	(2.49)	(.55)	(0)	(3.00)	(.45)	(1.14)	(2.49)	(1.81)	(1.91)

8. Feel More Tired and Worn Out *(Table 20)*

Means and standard deviations for item 8 are presented in Table 20. For OL, no main effects were found for day F (3,14) = .83, p = .50 (eta^2 = .15); group F (3,16) = 1.72, p = .20 (eta^2 = .24); or day X group F (3,16) = 1.25, p = .30 (eta^2 = .21). For OD, no main effects were found for day F (3,14) = 2.52, p = .10 (eta^2 = .35); group F (3,16) = 1.58, p = .23 (eta^2 = .23); or day X group F (3,16) = 1.2, p = .33 (eta^2 = .20).

Table 20

Means (Standard Deviations) for Outcome Expectations (OL and OD) Immediately After Exercise.(Feel More Tired and Worn Out: Item 8)

Energy Availability (n=5/EA)

		EA40		EA25		EA19		EA11		All EA Groups	
		OL	OD	OL	OD	OL	OD	OL	OD	OL	OD
Day 3	Mean	5.20	9.60	6.40	8.60	3.00	9.80	4.60	9.60	4.80	9.40
	(SD)	(3.35)	(.89)	(2.19)	(2.19)	(1.58)	(.45)	(1.67)	(.89)	(2.46)	(1.27)
Day 4	Mean	4.40	9.80	7.40	9.00	6.00	9.80	5.00	9.60	5.70	9.55
	(SD)	(2.97)	(.45)	(1.82)	(1.73)	(3.67)	(.45)	(2.74)	(.55)	(2.89)	(.94)
Day 5	Mean	4.80	9.80	7.60	8.60	6.20	10.00	4.00	9.40	5.65	9.45
	(SD)	(2.39)	(.45)	(2.30)	(1.67)	(2.86)	(0)	(2.24)	(.89)	(2.66)	(1.05)
Day 6	Mean	3.80	10.00	7.60	8.60	4.40	9.60	5.20	9.60	5.25	9.45
	(SD)	(2.49)	(0)	(2.51)	(1.52)	(3.58)	(.55)	(2.59)	(.55)	(2.99)	(.94)

9. Feel Refreshed and Alive *(Table 21)*

Means and standard deviations for item 9 are presented in Table 21. For OL, no main effects were found for day F (3,14) = 2.07, p = .15 (eta^2 = .31); group F (3,16) = 1.1, p = .38 (eta^2 = .17); or day X group F (3,16) =1.27, p = .29 (eta^2 = .21). For OD, no main effects were found for day F (3,14) = .57, p = .65 (eta^2 = .11); group F (3,16) = 2.72, p = .08 (eta^2 = .34); or day X group F (3,16) = 1.18, p = .34 (eta^2 = .20).

Table 21

Means (Standard Deviations) for Outcome Expectations (OL and OD) Immediately After Exercise (Feel Refreshed and Alive: Item 9)

		EA40		EA25		EA19		EA11		All EA Groups	
		OD	OL	OD	OL	OD	OL	OD	OL	OD	OL
Day 3	Mean	8.40	9.80	7.80	9.00	9.20	10.00	8.40	9.60	8.45	9.60
	(SD)	(1.52)	(.45)	(2.28)	(1.41)	(.84)	(0)	(1.34)	(.89)	(1.54)	(.88)
Day 4	Mean	8.00	9.80	6.20	9.20	7.60	9.60	8.60	9.40	7.60	9.50
	(SD)	(1.58)	(.45)	(1.10)	(1.30)	(2.79)	(.55)	(.89)	(.89)	(1.85)	(.83)
Day 5	Mean	8.20	9.80	7.20	9.20	7.00	10.00	8.00	9.60	7.60	9.65
	(SD)	(1.64)	(.45)	(.84)	(.84)	(2.55)	(0)	(1.58)	(.55)	(1.70)	(.59)
Day 6	Mean	8.00	10.00	6.20	8.20	7.00	9.60	8.20	9.80	7.35	9.40
	(SD)	(1.22)	(0)	(1.48)	(1.79)	(2.74)	(.55)	(.84)	(.45)	(1.79)	(1.14)

10. Feel Satisfied *(Table 22)*

Means and standard deviations for item 10 are presented in Table 22. For OL, no main effects were found for day F (3,14) = 1.7, p = .21 (eta^2 = .26); group F (3,16) = .09, p = .96 (eta^2 = .02); or day X group F (3,16) = 1.07, p = .41 (eta^2 = .18). For OD, no main effects were found for day F (3,14) = 1.43, p = .28 (eta^2 = .24); group F (3,16) = .48, p = .70 (eta^2 = .08); or day X group F (3,16) = 1.63, p = .15 (eta^2 = .25).

Table 22

Means (Standard Deviations) for Outcome Expectations (OL and OD) Immediately After Exercise.(Feel Satisfied: Item 10)

Energy Availability (n=5/EA)

		EA40		EA25		EA19		EA11		All EA Groups	
		OL	OD	OL	OD	OL	OD	OL	OD	OL	OD
Day 3	Mean	8.60	9.80	8.80	9.80	9.20	10.00	8.80	9.60	8.85	9.80
	(SD)	(1.34)	(.45)	(1.30)	(.45)	(.84)	(0)	(1.10)	(.55)	(1.09)	(.41)
Day 4	Mean	8.40	9.80	8.40	9.80	9.00	9.60	9.00	9.40	8.70	9.65
	(SD)	(1.14)	(.45)	(1.14)	(.45)	(.71)	(.55)	(1.00)	(.89)	(.98)	(.59)
Day 5	Mean	8.40	9.80	8.60	9.40	8.60	10.00	8.20	9.60	8.45	9.70
	(SD)	(1.14)	(.45)	(1.34)	(.89)	(.55)	(0)	(1.30)	(.55)	(1.05)	(.57)
Day 6	Mean	8.80	10.00	8.60	9.80	8.60	9.80	8.60	9.80	8.65	9.85
	(SD)	(.84)	(0)	(1.34)	(.45)	(1.14)	(.45)	(1.14)	(.45)	(1.04)	(.37)

11. Feel More Relaxed *(Table 23)*

For item 11, the means and standard deviations are in Table 23. No main effects were found for OL on day F (3,14) = .10, p = .96 (eta^2 = .02); group F (3,16) = .63, p = .60 (eta^2 = .11); or day X group F (3,16) = 1.34, p = .26 (eta^2 = .22). No main effects were found on OD on day F (3,14) = .82, p = .50 (eta^2 = .15); group F (3,16) = .67, p = .58 (eta^2 = .11); or day X group F (3,16) = 1.07, p = .41 (eta^2 = .18).

Table 23

Means (Standard Deviations) for Outcome Expectations (OL and OD) Immediately After Exercise.(Feel More Relaxed: Item 11)

Energy Availability (n=5/EA)

		EA40		EA25		EA19		EA11		All EA Groups	
		OL	OD	OL	OD	OL	OD	OL	OD	OL	OD
Day 3	Mean	8.20	10.00	7.40	9.20	8.40	9.20	8.80	9.40	8.20	9.45
	(SD)	(1.79)	(0)	(1.82)	(1.10)	(1.14)	(.84)	(.84)	(.89)	(1.44)	(.83)
Day 4	Mean	8.60	9.80	8.00	9.80	8.80	9.60	8.00	9.40	8.35	9.65
	(SD)	(1.14)	(.45)	(1.87)	(.45)	(1.10)	(.55)	(1.58)	(.89)	(1.39)	(.59)
Day 5	Mean	8.40	9.80	8.00	9.40	8.60	10.00	8.20	9.60	8.30	9.70
	(SD)	(1.14)	(.45)	(1.41)	(.89)	(.55)	(0)	(1.64)	(.55)	(1.17)	(.57)
Day 6	Mean	9.00	10.00	7.60	9.60	8.00	9.60	8.40	9.60	8.25	9.70
	(SD)	(.71)	(0)	(1.52)	(.89)	(1.0)	(.55)	(1.34)	(.55)	(1.21)	(.57)

12. Feel Less Stressed and Anxious *(Table 24)*

For item 12, the means and standard deviations are presented in Table 24. No main effects on OL were found for day F (3,13) = .81, p = .51 ($eta^2 = .16$); group F (3,15) = .28, p = .84 ($eta^2 = .05$); or day X group F (3,15) = 1.16, p = .36 ($eta^2 = .21$). No main effects were found on OD for day F (3,13) = .71, p = .56 ($eta^2 = .14$); group F (3,15) = 1.22, p = .34 ($eta^2 = 20$); or day X group F (3,15) = .66, p = .74 ($eta^2 = .13$).

Table 24
Means (Standard Deviations) for Outcome Expectations (OL and OD) Immediately After Exercise.(Feel Less Stressed and Anxious: Item 12)

		Energy Availability (n=5/EA)									
		EA40		EA25		EA19		EA11		All EA Groups	
		OL	OD	OL	OD	OL	OD	OL	OD	OL	OD
Day 3	Mean	8.20	10.00	9.00	9.60	9.00	9.80	9.50	9.25	8.89	9.68
	(SD)	(1.79)	(0)	(1.00)	(.89)	(1.22)	(.45)	(.58)	(.96)	(1.24)	(.67)
Day 4	Mean	8.80	9.80	8.40	9.80	8.00	9.40	8.50	9.50	8.42	9.42
	(SD)	(.84)	(.45)	(1.67)	(.45)	(.71)	(.89)	(1.91)	(2.38)	(1.26)	(1.22)
Day 5	Mean	8.40	9.80	8.20	9.40	8.60	10.00	9.25	9.25	8.58	9.63
	(SD)	(1.14)	(.45)	(1.64)	(.89)	(.55)	(0)	(.96)	(.96)	(1.12)	(.68)
Day 6	Mean	9.00	10.00	7.80	9.60	8.20	9.60	8.50	8.50	8.37	9.47
	(SD)	(.71)	(0)	(1.48)	(.89)	(.84)	(.55)	(1.91)	(2.38)	(1.26)	(1.22)

Outcomes One or Two Days After Exercise *(Items 13-20)*

13. Feel Good Physically *(Table 25)*

For item 13, means and standard deviations are presented in Table 25. No main effects on OL were found for day F(3,14) = .23, p = .87 ($eta^2 = .05$); group F (3,16) = .18, p = .91 ($eta^2 = .03$); or day X group F (3,16) = 1.0, p = .46 ($eta^2 = .17$). No main effects on OD were found for day F (3,14) = 1.12, p = .38 ($eta^2 = .19$); group F (3,16) = 1.21, p = .34 ($eta^2 = .18$); or day X group F (3,16) = 1.2.

Table 25
Means (Standard Deviations) for Outcome Expectations (OL and OD) One or Two Days After Exercise.(Feel Good Physically: Item 13)

Energy Availability (n=5/EA)

		EA40		EA25		EA19		EA11		All EA Groups	
		OL	OD	OL	OD	OL	OD	OL	OD	OL	OD
Day 3	Mean	8.20	9.80	8.00	9.20	8.40	9.80	9.00	9.80	8.40	9.65
	(SD)	(1.48)	(.45)	(2.45)	(.84)	(2.07)	(.45)	(1.00)	(.45)	(1.73)	(.59)
Day 4	Mean	8.60	9.80	8.20	9.40	8.80	9.80	8.60	9.70	8.55	9.68
	(SD)	(1.14)	(.45)	(2.49)	(.89)	(.84)	(.45)	(1.34)	(.45)	(1.47)	(.57)
Day 5	Mean	9.00	9.80	8.20	9.40	8.20	10.00	8.40	9.80	8.45	9.75
	(SD)	(1.41)	(.45)	(2.05)	(.89)	(.84)	(0)	(1.52)	(.45)	(1.43)	(.55)
Day 6	Mean	8.60	10.00	7.80	9.60	8.80	10.00	8.60	9.80	8.45	9.85
	(SD)	(1.14)	(0)	(2.49)	(.55)	(1.30)	(0)	(1.14)	(.45)	(1.54)	(.37)

14. Feel Generally Happier/Feel Better Emotionally *(Table 26)*

For item 14, means and standard deviations are presented in Table 26. No main effects were found on OL for day F (3,14) = .39, p = .76 (eta^2= .08); group F (3,16) = .29, p = .83 (eta^2 = .05); or day X group F (3,16) = .83, p = .59 (eta^2 = .15). No main effects were found on OD for day F (3,14) = 1.83, p = .19 (eta^2 = .28); group F (3,16) = 1.69, p = .21 (eta^2 = .24); or day X group F (3,16) = .72, p = .68 (eta^2= .13).

Table 26
Means (Standard Deviations) for Outcome Expectations (OL and OD) One or Two Days After Exercise (Feel Generally Happier/ Feel Better Emotionally: Item 14)

Energy Availability (n=5/EA)

		EA40		EA25		EA19		EA11		All EA Groups	
		OL	OD	OL	OD	OL	OD	OL	OD	OL	OD
Day 3	Mean	8.40	10.00	7.80	9.40	8.40	10.00	9.00	9.80	8.40	9.80
	(SD)	(1.14)	(0)	(2.49)	(.89)	(2.07)	(0)	(1.00)	(.45)	(1.70)	(.52)
Day 4	Mean	8.60	9.80	8.20	9.40	8.60	10.00	8.60	9.70	8.50	9.73
	(SD)	(1.14)	(.45)	(2.49)	(.89)	(.89)	(0)	(1.34)	(.45)	(1.47)	(.55)
Day 5	Mean	9.20	9.80	8.00	9.40	8.40	10.00	8.80	9.80	8.60	9.75
	(SD)	(1.10)	(.45)	(2.45)	(.89)	(.89)	(0)	(1.30)	(.45)	(1.50)	(.55)
Day 6	Mean	8.80	10.00	8.00	9.60	8.40	10.00	8.80	10.00	8.50	9.90
	(SD)	(.84)	(0)	(2.45)	(.55)	(1.52)	(0)	(1.30)	(0)	(1.54)	(.31)

15. Feel Stiff/Sore Body *(Table 27)*

For item 15, means and standard deviations are presented in table 27. No main effects on OL were found for day F (3,14) = 1.07, p = .39 (eta^2 = .19); group F (3,16) = .69, p = .57 (eta^2 = .11); or day X group F (3,16) = 1.1, p = .39 (eta^2 = .19). No main effects on OD were found for day F (3,14) = .55, p = .66 (eta^2 = .11); group F (3,16) = 1.5, p = .25 (eta^2 = .22); or day X group F (3,16) = 1.1, p = .39 (eta^2 = .19).

Table 27

Means (Standard Deviations) for Outcome Expectations (OL and OD) One or Two Days After Exercise (Feel Stiff/Sore Body: Item 15)

		Energy Availability (n=5/EA)									
		EA40		EA25		EA19		EA11		All EA Groups	
		OL	OD	OL	OD	OL	OD	OL	OD	OL	OD
Day 3	Mean	7.00	3.40	5.60	3.40	5.80	1.60	6.40	4.80	6.20	3.30
	(SD)	(1.41)	(1.52)	(1.82)	(2.51)	(3.56)	(1.34)	(1.34)	(2.77)	(2.12)	(2.27)
Day 4	Mean	7.00	3.80	6.20	3.40	4.40	1.20	6.80	3.60	6.10	3.00
	(SD)	(1.22)	(2.68)	(.84)	(2.88)	(3.65)	(.45)	(1.79)	(2.41)	(2.25)	(2.38)
Day 5	Mean	6.20	3.80	5.80	3.00	3.80	1.60	5.60	4.60	5.35	3.25
	(SD)	(2.39)	(1.79)	(2.39)	(2.92)	(3.49)	(1.34)	(1.52)	(3.21)	(2.52)	(2.51)
Day 6	Mean	6.00	3.40	6.40	2.60	5.40	2.00	5.40	4.00	5.80	3.00
	(SD)	(.71)	(1.67)	(1.95)	(2.19)	(2.70)	(2.24)	(2.07)	(2.83)	(1.88)	(2.22)

16. Feel Better About Yourself/More Confident *(Table 28)*

For item 16, means and standard deviations are presented in Table 28. No main effects were found on OL for day F (3,14) = .54, p = .67 (eta^2 = .1); group F (3,16) = .29, p = .83 (eta^2 = .05); or day X group F (3,16) = 1.29, p = .28 (eta^2 = .21). No main effects were found on OD for day F (3,14) = .65, p = .60 (eta^2 = .12); group F (3,16) = .55, p = .66 (eta^2 = .09); or day X group F (3,16) = .84, p = .58 (eta^2 = .15).

Table 28

Means (Standard Deviations) for Outcome Expectations (OL and OD) One or Two Days After Exercise (Feel Better About Yourself/More Confident: Item 16)

Energy Availability (n=5/EA)

		EA40		EA25		EA19		EA11		All EA Groups	
		OL	OD	OL	OD	OL	OD	OL	OD	OL	OD
Day 3	Mean	8.60	9.40	7.60	9.20	7.20	10.00	8.20	9.60	7.90	9.55
	(SD)	(1.14)	(1.34)	(2.88)	(1.30)	(1.92)	(0)	(1.48)	(.89)	(1.89)	(1.00)
Day 4	Mean	8.20	9.80	8.20	9.20	7.40	9.80	7.20	9.80	7.75	9.40
	(SD)	(1.30)	(.45)	(2.49)	(1.30)	(1.67)	(.45)	(2.59)	(2.17)	(1.97)	(1.27)
Day 5	Mean	8.80	9.40	7.60	9.40	7.80	10.00	8.00	9.80	8.05	9.65
	(SD)	(1.30)	(.89)	(2.88)	(.89)	(.84)	(0)	(1.58)	(.45)	(1.73)	(.67)
Day 6	Mean	8.60	9.20	8.40	9.40	8.00	10.00	8.00	9.60	8.25	9.55
	(SD)	(1.67)	(1.79)	(1.52)	(.89)	(1.58)	(0)	(1.58)	(.55)	(1.48)	(1.00)

17. Have More Energy *(Table 29)*

Means and standard deviations for item 17 are presented in Table 29. No main effects were found on OL for day F (3,14) = 1.73, p = .21 (eta^2 = .27); group F (3,16) = .66, p = .59 (eta^2= .11); or day X group F (3,16) = 1.51, p = .19 (eta^2 = .24). No main effects were found on OD for day F (3,14)= .51, p = .69 (eta^2 = 10); group F (3,16) = .84, p = .49 (eta^2 = .14); or day X group F (3,16) = .80, p = .62 (eta^2 = .14).

Table 29

Means (Standard Deviations) for Outcome Expectations (OL and OD) One or Two Days After Exercise (Have More Energy: Item 17)

Energy Availability (n=5/EA)

		EA40		EA25		EA19		EA11		All EA Groups	
		OL	OD	OL	OD	OL	OD	OL	OD	OL	OD
Day 3	Mean	8.40	10.00	7.00	9.00	7.60	9.60	8.60	9.80	7.90	9.60
	(SD)	(1.14)	(0)	(3.32)	(1.41)	(1.67)	(.89)	(1.67)	(.45)	(2.05)	(.88)
Day 4	Mean	8.40	9.80	7.00	9.20	7.80	9.80	8.20	9.60	7.85	9.60
	(SD)	(1.14)	(.45)	(3.32)	(1.30)	(1.64)	(.45)	(1.30)	(.55)	(1.95)	(.75)
Day 5	Mean	8.60	9.80	7.00	9.40	6.60	9.60	8.00	9.80	7.55	9.65
	(SD)	(1.34)	(.45)	(3.32)	(.89)	(2.07)	(.89)	(2.12)	(.45)	(2.28)	(.67)
Day 6	Mean	8.60	9.80	7.00	9.40	7.40	10.00	8.20	9.80	7.80	9.75
	(SD)	(1.14)	(.45)	(2.55)	(.89)	(1.34)	(0)	(1.64)	(.45)	(1.74)	(.55)

18. Be More Tired *(Table 30)*

For item 18, means and standard deviations are presented in Table 30. No main effects were found on OL for day F (3,14) = .22, p = .88 ($eta^2 = .05$); group F (3,16) = 1.18, p = .35 ($eta^2 = .18$); or day X group F (3,16) = .42, p = .92 ($eta^2 = .08$). For OD, no main effects were found for group F (3,16) = 1.56, p = .24 ($eta^2 = .23$) or day X group F (3,16) = 1.09, p = .40 ($eta^2 = .19$). However, a main effect was found for day F (3,14) = 4.05, p = .03 ($eta^2 = .47$). Post hoc tukey tests found no significant differences between groups.

Table 30
Means (Standard Deviations) for Outcome Expectations (OL and OD) One or Two Days After Exercise (Be More Tired: Item 18)

Energy Availability (n=5/EA)

	EA40		EA25		EA19		EA11		All EA Groups		
	OL	OD	OL	OD	OL	OD	OL	OD	OL	OD	p value
Day 3	4.20	1.60	4.6	1.40	2.80	1.40	2.80	1.60	3.60	1.50	$.05_{day}$
	(2.39)	(1.34)	(2.88)	(.55)	(2.95)	(.55)	(1.79)	(1.34)	(2.48)	(.95)	
Day 4	3.80	1.20	5.20	1.20	2.80	1.20	3.80	1.40	3.90	1.25	
	(2.17)	(.45)	(3.03)	(.45)	(1.10)	(.45)	(1.64)	(.89)	(2.13)	(.55)	
Day 5	3.80	1.80	5.40	1.40	2.40	1.40	4.10	2.20	3.93	1.70	
	(2.59)	(1.10)	(2.51)	(.55)	(1.52)	(.89)	(2.46)	(1.64)	(2.39)	(1.08)	
Day 6	4.00	4.40	5.00	1.00	3.80	1.20	4.00	2.20	4.20	2.20	
	(3.39)	(3.51)	(2.74)	(0)	(1.79)	(.45)	(2.35)	(1.64)	(2.46)	(2.26)	

day = main effect found for OD, however post hoc tukey tests found no significant differences between groups

19. Feel Less Stressed and Anxious *(Table 31)*

For item 19, means and standard deviations are presented in Table 31. No main effects were found on OL for day F (3,14) = .91, p = .46 ($eta^2 = .16$) or group F (3,16) = .06, p = .98 ($eta^2 = .01$); but a day X group interaction was found F (3,16) = 2.19, p = .048 ($eta^2 = .31$). Post hoc tukey tests found no significant differences between groups. For OD, no main effects were found for day F (3,14) = 2.12, p = .14 ($eta^2 = .31$);

group F (3,16) = .0, p = 1.0 (eta^2 = .00); or day X group F (3,16)= .79, p = .62 (eta^2 = .14).

Table 31

Means (Standard Deviations) for Outcome Expectations (OL and OD) One or Two Days After Exercise (Feel Less Stressed and Anxious: Item 19)

Energy Availability (n=5/EA)

	EA40		EA25		EA19		EA11		All EA Groups		
	OL	OD	OL	OD	OL	OD	OL	OD	OL	OD	p value
Day 3	7.00 (3.00)	8.00 (3.94)	7.20 (3.35)	9.00 (1.41)	7.60 (1.14)	7.60 (3.91)	9.00 (1.41)	9.20 (1.30)	7.70 (2.36)	8.45 (2.78)	$.05_{dxg}$
Day 4	7.80 (1.48)	9.80 (.45)	7.40 (2.97)	9.20 (1.3)	7.80 (1.64)	8.20 (4.02)	6.60 (3.05)	8.00 (3.94)	7.40 (2.26)	8.80 (2.76)	
Day 5	8.20 (1.64)	9.80 (.45)	7.60 (2.88)	9.80 (.45)	7.20 (1.79)	10.00 (0)	8.20 (1.79)	9.60 (.55)	7.80 (1.96)	9.80 (.41)	
Day 6	6.80 (3.27)	8.20 (4.02)	7.60 (1.95)	8.00 (3.46)	7.80 (.84)	10.00 (0)	7.60 (1.67)	9.40 (.89)	7.45 (1.99)	8.90 (2.61)	

dxg (day by group) = main effect for OL, however post hoc tukey tests found no significant differences between groups

20. Feel Satisfied *(Table 32)*

For item 20, means and standard deviations are presented in Table 32. No main effects were found on OL for day F (3,14), p = .10 (eta^2 = .35) or group F (3,16) = .37, p = .78 (eta^2 = .06); but, a day X group interaction was found F (3,16) = 2.3, p = .038 (eta^2 = .32). Post hoc tukey tests were done and no significant differences were found between groups. For OD, no main effects were found for day F (3,14) = 1.7, p = .21 (eta^2 = .27); group F (31,16) = .47, p = .71 (eta^2 = .08); or day X group F (3,16) = .78, p = .64 (eta^2 = .14).

Table 32

Means (Standard Deviations) for Outcome Expectations (OL and OD) One or Two Days After Exercise (Feel Satisfied: Item 20)

Energy Availability (n=5/EA)

	EA40		EA25		EA19		EA11		All EA Groups		
	OL	OD	OL	OD	OL	OD	OL	OD	OL	OD	p value
Day 3	8.20	8.00	7.40	9.20	9.60	9.80	8.80	9.80	8.50	9.20	.04$_{dxg}$
	(1.30)	(3.94)	(3.29)	(1.10)	(.55)	(.45)	(.84)	(.45)	(1.88)	(2.04)	
Day 4	8.00	9.80	7.60	9.20	8.80	9.80	7.80	9.60	8.05	9.60	
	(1.22)	(.45)	(2.88)	(1.30)	(.84)	(.45)	(1.79)	(.55)	(1.76)	(.75)	
Day 5	8.60	9.80	7.80	9.60	8.40	10.00	8.00	9.80	8.20	9.80	
	(1.34)	(.45)	(2.86)	(.55)	(.55)	(0)	(1.58)	(.45)	(1.67)	(.41)	
Day 6	8.40	10.00	8.40	9.60	8.60	9.80	7.80	9.80	8.30	9.80	
	(1.14)	(0)	(1.52)	(.55)	(1.67)	(.45)	(1.79)	(.45)	(1.45)	(.41)	

dxg (day by group) = main effect for OL, however post hoc tukey test found no significant differences between groups

CHAPTER 5

DISCUSSION

The primary purpose of this study was to investigate the psychosocial outcomes of attitudes, self-efficacy and outcome expectations in conjunction with a physiological study involving acute, exercise bouts of a long duration and controlled EA in a homogenous sample of overweight women. However, a major limitation of the current study was the small sample size.

Although hundreds of women phoned or e-mailed in their interest, only 20 actually participated and completed the study. This allowed for only five participants within each EA group. A study that was similar in terms of the physiological component indicated 18 participants were needed per group (Loucks & Callister, 1993). However, Loucks and Heath (1994) found statistical findings physiologically with five to eight women per group. Due to time constraints with data collection, time commitment required to be involved with the study, and the difficulty of finding participants to meet all of the entry criteria, only 20 females participated in this study.

With the study taking place over six consecutive days, many women were unable to participate because of the large amount of time needed in such a short time frame, especially those that worked full-time or had small children. Also, with the duration on the three exercise days ranging from 2.5 to 4.5 hours including the blood work and questionnaire prior to exercising, many women were deterred from participating in the study. As a result of the exercise, one participant experienced a great deal of muscle soreness and dropped out of the study. Also, more than two participants at the same time, was not feasible with this investigation as each person had to be hooked up to a metabolic cart periodically throughout the exercise bouts to ensure intensity was maintained.

When recruiting overweight females for the study, stringent criteria were put forth (see methods and results section). Many women did not meet this criteria for one reason or another that would affect hormonal status (for example, being on birth control pill or thyroid medication).

Another factor that lad to fewer women participating than originally planned was the amount of time that passed from the first meeting with the researcher and the actual participation in the 6-day study. With too much time lapsing, interest waned or other priorities took precedence. Several factors were connected to this time lapse. One included the completion of a 7-day diet record prior to participation in the 6-day study. It was important to get the diet record before beginning the 6-day study, so an understanding of normal eating patterns could be obtained. One participant started the 6-day study before completing the diet record and failed to bring it in even after several reminders.

Secondly, the researcher had to wait for the menstrual cycle to begin before the study could commence, with day 6 of the menstrual cycle being the last possible start date. By the time some potential participants' menstrual cycles began other commitments such as family or exams were given higher priority, so then the researcher would wait until the next cycle or the next one after that. As a result, these participants were no longer interested in doing the study. Although the researcher tried to focus on the incentives gained from participating in the study such as diet record analysis, fitness assessments and research outcomes, participants could not be convinced to partake in the study. It took eleven months to get 20 people, at which point, the researcher decided to analyze the results and write everything up.

Demographics

The influence of the small sample size on the statistical analyses is apparent in examination of the demographic data. Although no significant findings between groups were found, EA11 (the lowest EA group) was generally lighter in weight and had lower percent body fat than the other three EA groups. This in turn affected their relative maximal oxygen consumption with the mean score in the EA11 group being higher than the other three groups. However, absolute maximal oxygen consumption indicated all four groups to be at a similar fitness level. Although the study was on overweight women there was no upper limit on body mass index (BMI) set when recruiting participants, it only had to be greater than 26kg/m^2. Overweight is defined as a BMI between 26-30kg/m^2 (Canadian Association of Sports Sciences, 1987). As a result, 11 of the 20 women in this study had BMIs greater than 30. Four of these obese women were in EA40, three in EA25, three in EA19, and only one in EA11. This contributed to the lower mean for body weight and body fat in the EA11 group

Psychological Variables

Attitudes, self-efficacy theory, along with outcome expectations have been used to help researchers understand the determinants of physical activity. Knowledge of determinants in overweight women can therefore lead to appropriate interventions being designed and implemented in this understudied population who have so much to gain in terms of improved health and a better quality of life. By examining overweight women in an acute exercise environment, a better understanding of these psychological constructs could be obtained.

The small sample size and the variance in responses as indicated by the standard deviations, contributed to the low power and mostly non-significant findings. Interpretation of the results was difficult as there were close to significant findings and large effect sizes in some areas. Even one outlier between groups with only five people in each group greatly influenced the statistical analyses.

In comparing baseline responses on day three for many of the questions, there was a lot of variability between groups. However, even within each EA group, there was considerable variability in some instances and no variability in others. For example with outcome expectations, item one, “get sweaty”, for outcome desirability for EA25, the standard deviation was 3.7, however for the same group for OL there was 0 variance. This makes any baseline comparisons between EA groups difficult. It was hypothesized that with time, EA groups would be different with the EA40 having higher scores by day 6. With the fluctcuation in responses by each participant, no baseline comparisons could be made.

Attitudes

For attitudes, both evaluative and affective, no main effects were found. With evaluative attitudes, the effect sizes were fairly large, .29 for day, .33 for group and .19 for day by group indicating a large amount of change in the dependent variable over time. However, the low power as a result of the small sample prevented significant results occurring. In the EA25 group it was interesting that every participant responded with a 9.0 on each of the four days the questionnaires were filled out, indicating no variance in this group. A larger sample would have more variance with their responses to the question. The effect sizes were not as large with affective attitudes with the highest one being .24 for the day x group interaction.

In this study, overweight women had positive attitudes with regards to exercise. These attitudes were not changed when combined with controlled energy intake and energy expenditure. Unlike Wilcox and Storandt (1996), the current study did not categorize participants based on age or exercise status. Although, most of the participants in this study said they were active on a regular basis when they completed the demographic questionnaire, non-exercisers' and exercisers' attitude responses did not indicate any differences. This study partially supports Wilcox and Storandt's study that found exercisers to be more positive than non-exercisers as most women in the present study were exercisers. However, non-exercisers also had positive attitudes. In addition, women were under forty years of age, further supporting their research of young women having positive attitudes. Women in this study were not only young, but also overweight. Consequently, this research adds to the attitude literature on women.

It was hypothesized that evaluative attitudes would remain unchanged throughout the duration and affective attitudes would decrease because of this acute exercise experience. As a result of the non-significant findings, this hypothesis was not supported. The long duration in this study may have been seen as a one time experience, not realistic compared to the normal exercise environment. Thereby, participants' attitudes were not affected. Participants probably felt that for three days, they could endure this atypical exercise environment, and therefore responded more to the general exercise setting. A longer study, at the same duration may have changed affective attitudes, but for three days, the participants in this study may have felt that they could do this, as it was something they would probably never do again. Participants probably responded to the questionnaire, not in the context of the current investigation, but in terms of generally recommended exercise practice.

In the current investigation, evaluative attitudes were found to be more positive than affective attitudes. Azjen and Timko (1986) found health behavior to be predicted with greater accuracy from an affective versus an evaluative measure of attitude. These authors refer to affective attitudes as the enjoyment factor with these attitudes reflecting the pleasures/displeasures associated with performing generally recommended health practices. Because most people know the advantages of exercise, evaluative attitudes would be responded with more positive scores as the items representing this construct are bipolar adjectives on the advantages/disadvantages of exercise. However, affective attitudes would provide knowledge on the emotions/feelings associated while exercising and would generally be different from evaluative attitudes. Despite the fact that non-significant findings occurred, lower overall responses on affective attitudes compared to evaluative attitudes showed that overweight women did not regard exercise to be super enjoyable even though they positively evaluated it. This therefore, provides some support for Azjen and Timko with affective attitudes lower in the current study. Consequently, overweight women evaluate exercise as being beneficial and have positive attitudes toward exercise.

It was also hypothesized that attitudes would be different between groups with EA40 having higher attitudes by day 6 followed by subsequent decreases in the remaining three EA groups. There was no significant difference between groups over the four days attitudes were measured. Therefore, this hypothesis was not supported. One explanation for this was the disparity in responses by a small sample greatly affecting the results. Also, this acute experience may not have been long enough to have an effect on changing attitudes between groups.

Self-Efficacy

No main effects were found for coping or task efficacy. However, there were large effect sizes for day and day by group for coping and close to significant findings for day (.08). As well, there was a large effect size and a close to significant finding for task for day (.07). Again, a larger sample size would have increased the power and the probability of a significant finding. A main effect for group was found for scheduling efficacy with EA25 showing significantly higher scheduling efficacy than the other three EA groups. The reason for this result is unclear as this group is the second highest EA group. The only plausible explanation is the small sample size.

It was hypothesized that self-efficacy would increase by day 6 for each of the groups. Because of the non-significant findings, this hypothesis was refuted. However, task efficacy scores were quite high, indicating that overweight women were already high in this type of efficacy. Rodgers and Sullivan (in press) found both exercisers and non-exercisers to have high task efficacy. Although, participants in this study were not categorized into exercisers and non-exercisers, overall, task efficacy was high. Support was therefore provided for Rodgers and Sullivan's research. With regards to the items in the questionnaire on task efficacy, the four items that were assessed ("pace yourself to avoid over-exertion", "perform all the required movements", "follow directions from an instructor", "check how hard your activity is making you work") were probably not much of a barrier for these women, considering the intensity was moderate (80-90% VT, lowered to 80% if it was too difficult); cycling was not too skill oriented, no directions were needed, and a heart rate monitor was worn and intensity monitored so participants always knew how hard they were working.

McAuley et al (1995) and McAuley, Courneya, et al (1991) found acute and chronic exercise to significantly increase self-efficacy. However, chronic exercise participation made more dramatic increases in self-efficacy. Acute exercise self-efficacy was measured in both of these studies before and after graded exercise testing. Although the current study was on acute exercise, the questionnaire may not have captured this specific exercise experience thereby not significantly affecting self-efficacy.

In addition to this, the items addressing coping and scheduling efficacy were more on a general exercise experience (see Appendix B). For example, some of the items addressed confidence to exercise "when tired", or "in a bad mood" or to "exercise regularly, no matter what". Perhaps questions more specific to this particular exercise experience would have found different responses.

It was also hypothesized that self-efficacy would be higher for EA40, and linearly decrease in the lower EA groups. This hypothesis was refuted by the current investigation. Rodgers and Sullivan (in press) found exercisers to have higher coping and scheduling efficacy. This study was categorized by EA, and the non-significant findings did not allow for any conclusions to be drawn. The small sample size, the variability in responses, as well as the questionnaire not measuring specifically this exercise situation or participants responding to the questionnaire in terms of general exercise may have contributed to the non-significant findings.

Outcome Expectations

Several main effects were found for outcome expectations. For outcomes during exercise, item 6, " feel satisfied" for OD had a main effect for day. For outcomes 1 or 2 days after exercise, there was a main effect for OD for day for item 18, "be more tired" as well as a day x group interaction for OL for items 19, "feel less stressed and anxious" and 20, "feel satisfied". However, for these outcomes, post hoc tukey tests were performed and non-significant findings were found. Other outcomes also approached significance. Items 2, "increase your heart rate" and 5 "feel exhausted" both approached significance (p=.06) for day and OD.

Although non-significant findings were found for each of the 20 outcomes for OD and OL, the effect sizes were reaching meaningful values. The reasons for the non-significant findings again have to do with the small amount of women in each group.

The responses on some of the outcome items were not expected. For example, for item 7, "feel more alert/awake", for OD, all the groups responded with low values (from 1.0, the lowest average response to 3.6, the highest average response). It is hard to understand why overweight women would not want to feel more alert or awake with exercise. A general expectation would be that most people would want to feel more alert and awake, as a benefit of exercise. On another item, item 8, "feel more tired and worn out", all EA groups responded high (from 8.6, the lowest response to 10.0, the highest response). Again, it is unusual that overweight women would want to feel more tired and worn out because the general expectation would be that one would not want to feel more tired and worn out. Perhaps, the cognitions of overweight women are different than expected. Their thoughts may be in conjunction with the old American College of Sports

Medicine (ACSM) guidelines where frequency, intensity, and duration at a prescribed amount were recommended for fitness benefits. Exercise was therefore seen by many as hard. Participants in this study may have felt that with exercise, if they were to benefit from it, it had to be strenuous. Accordingly, they should feel tired and desire that to gain the benefits. In contrast, "feeling more alert or awake" would indicate participants had not worked hard enough. Hence, this item was seen as low in desirability.

It was hypothesized that some outcome expectancies would increase and some would decrease. The non-significant findings refuted this hypothesis. It was also hypothesized that outcome expectations would be different between groups. This hypothesis was also refuted.

From the current investigation, with the variability in responses and the non-significant findings, it was hard to determine the outcomes these women anticipated as a result of participating in the study. Therefore, comparisons with the relevant literature on outcome expectations were difficult especially with two of the studies examining outcome values and outcome likelihood, as well as proximal and distal outcomes (Rodgers and Brawley, 1996; Rodgers & Gauvin, 1998). This study looked at OL and OD and did not examine proximal or distal outcomes.

Further, to address Rodgers and Gauvin (1998) and Rodgers and Brawley (1996) comments on the few studies examining outcome expectations and self-efficacy together, this study had hoped to contribute to this literature. However, the small sample size did not allow the power to group the two psychological variables together. Instead, each outcome item was analyzed on its own. A construct on its own loses some of its explanation when it can not relate it to other constructs in a theory. It then becomes more descriptive. Therefore, outcome expectations in this investigation attempted to describe the outcomes of overweight women with little success obtained

Summary of Findings

It was hoped that this study would fill in some of the gaps in the literature. This was accomplished by studying overweight women and adding to the current research on women and overweight individuals. Further knowledge was obtained from this study on overweight women. They demonstrated positive evaluations of exercise as well as positive attitudes towards the exercise experience itself. Because of some of the unusual responses, it could be questioned whether self-efficacy or outcome expectations in overweight women differ significantly from normal weight women. The study by McAuley (1992) found percent body fat to be significantly correlated with self-efficacy, with people of higher body fat having lower self-efficacy than individuals with lower body fat. This had a direct effect on general beliefs about physical capability and on frequency of exercise behaviour with leaner individuals attending more classes. In a non-structured environment, McAuley and Jacobson (1992) found no difference in body weight between those that attended on a regular basis and those that periodically attended. On the other hand, differences in body weight between adherers and non-adherers in a structured fitness environment were found. McAuley and Jacobson suggest that heavier individuals may choose or prefer to exercise on their own. These studies demonstrate that people of higher body fat do in fact respond differently than people of lower body fat. Perhaps overweight women are more sensitive to their weight and may not want to be in a structured exercise environment as their weight is an issue.

This could be important from an intervention perspective, with programs designed to be less structured and formal. Perhaps not meeting at a fitness facility, where overweight women may feel uncomfortable, or designing fitness classes specifically for overweight individuals so modelling (a source of self-efficacy) to other similar individuals can take place and increase self-efficacy.

Overweight women in this study perceived exercise to be more desirable if they were tired and worn out. Consequently, they may need to be educated more on the benefits that can be gained even from moderate amounts of physical activity and the new recommendations set forth by the ACSM.

Although a small sample size was used for this study, the questionnaires were filled out based on an exercise experience where caloric intake and energy expenditure was strictly controlled. Heart rate and intensity (via a metabolic cart) were monitored throughout the exercise treatment. Most psychological research, on the other hand, involves filling out questionnaires on their own or as part of an intervention with few studies measuring objective indicators.

With self-efficacy, further support was provided for Rodgers and Sullivan's (in press), types of efficacy, differentiating the three types of efficacy. High internal consistencies for each efficacy was found in the current study indicating high construct validity. Future research would help to determine if these psychological variables are affected by energy intake.

With the exception of scheduling efficacy, no significant changes in the psychological variables assessed were observed in this study. However, sample size may not have allowed the statistical power to identify significant differences between day, group, or day x group. Power is influenced by effect size, significance level, and sample size. To increase power with a small sample, a larger effect size is needed to reach significance. Besides this major limitation, other limitations to the study may have influenced the results.

Study Limitations

1. External Validity: Generalizability Across Settings

The investigation took place in a controlled lab setting to monitor speed and intensity on the bike as well as energy intake through liquid supplementation. Generalizations outside of this setting are therefore difficult. Also, the exercise duration each day was longer than what takes place in an average exercise setting (with durations from 150 minutes up to 223 minutes). Because this study was done in a controlled lab setting, it is unknown at present if this study is generalizable to the free-exercise environment where participants are exercising on their own without intensity and duration being monitored.

2. External Validity: Generalizability Across Times

The present study had participants exercising at different times of the day with some participants exercising early in the morning, others in the afternoon, and others in the evening. Although each participant herself, exercised at the same time during the three days, within and between groups, exercise times varied.

3. Construct Validity

Expectancy effects may have impaired construct validity when either the researcher's or participant's behaviour increased the chance of the alternative hypotheses being realized (Gauvin & Brawley, 1993). These authors imply that with studies on exercise, it is difficult to blind participants and experimenters as the psychological and physiological benefits of exercise are well known through the media, fitness clubs, and health organizations. With the psychological scales used, participants may have responded higher if they were trying to look better than they are.

4. Lack of Theory

By using attitudes as a construct on its own and not as part of the TPB, it loses some of its predictability in explaining exercise behaviour and becomes more descriptive. With outcome expectations, it was hoped to use it as part of self-efficacy theory, however, the small sample size prevented this from happening. There was not enough power to group outcome expectations with self-efficacy, therefore it became a construct on its own and also became more descriptive. According to Godin (1994), the final behaviour reflects the summed effect of all the factors involved. Two variables in this study were examined as a construct and not together to get a bigger picture and a better understanding of what was happening with these participants.

5. Internal Validity: Volunteers

Random assignment of participants from the general population did not occur in this investigation. Women that volunteered for this study may have had a stronger desire to become more active and healthy compared to the average overweight woman; therefore, an inference from the sample in this study may be difficult as they were not representative of the general population.

6. Internal Validity: Selection

Women that were both sedentary and active participated in the study.

7. Internal Validity: Statistical Analyses

There was very little variance with the results on some cases, whereas some of the scores were difficult to interpret and may be the result of an outlier.

8. Internal Validity: History

Because there was no control group, something in the exercise environment may have lead to differences in the dependent variable. For example, some participants exercised at the same time as another participant from the study. This may have affected their cognitions. Also, at times, other things were going on in the lab such as fitness testing which again could affect the results. The movies watched after the first few bouts of exercise could also have affected the exercise experience for some of the participants.

9. Internal Validity: Overweight Sample

Although all the participants were overweight with a BMI greater than 26, five participants had a BMI greater than 30 and this affected the demographic results of the groups with the red group showing a lower mean for body weight and percent body fat.

10. Self-Reported Measures

The results of this study were based upon self-reported data, therefore, error in memory, recall or biased reporting may have influenced the participants' responses.

Delimitations

1. High Internal Validity: Setting

The experiment occurred in a controlled lab setting where intensity of the exercise, energy intake, and extraneous variables such as noise, social influences, and any other distractions that may have affected the outcome of the study were controlled.

2. Internal Validity: Overweight Females

The sample was restricted to overweight females between 18 and 40 years of age with a BMI of greater than 26.

3. Internal Validity: Healthy Sample

The sample was restricted to healthy, asymptomatic, non-smokers with regular menstrual cycles.

4. Internal Validity: No Prescriptions that Would Affect Hormonal Status

The sample was restricted to women who were not on birth control or any medications that affected hormonal status.

5. Internal Validity: Random Assignment

Each participant was randomly assigned to an energy intake group once recruited for the study.

6. External Validity: University and Community Volunteers

Although volunteer samples are not representative of the general population, this study was not just university students as the majority of studies are. This study also included women from outside of the university community. This definitely increases the external validity of the study.

Conclusion

These results provide little support for change in attitudes, self-efficacy and outcome expectations in overweight women over a short time. The conceptual and methodological limitations have been addressed with sample size being a major issue that affected overall power and results. Perhaps a larger sample or even a longer duration would have captured more psychological information. Had there been significant findings, and the lower EA groups were affected psychologically by the insufficient energy intake, this would have important practical implications. It would be important to ensure that overweight women are getting sufficient energy for normal psychological function while exercising.

However, an absence of significant effects does not mean that these psychological variables are unimportant. It is not certain that the right psychological variables were used to capture this unique exercise experience as indicated by the diverse responses.

Where To Go From This Investigation

The primary goal of this investigation was to explain and describe exercise behavior in overweight women when energy intake and exercise expenditure were controlled. This study consisted of a long duration over three days to examine thyroid metabolism. It was hypothesized that this acute experience would affect affective attitudes, self-efficacy and outcome expectations. However, the questionnaire used may not have been specific enough to measure the exercise setting in this study. Besides the small sample, participants may have responded to the questionnaire more generally to exercise rather than this specific situation. The researcher hoped that the long duration over such a short time would change these psychological variables. Based on the researcher's experience with working with the participants throughout the six days of the study, while keeping them motivated and entertained many things were experienced in the study, however, these items were not measured. A qualitative analysis may have provided more information.

When giving back the results to the participants of their diet records and fitness testing several months following their completion, some of the participants' lifestyles had changed to exercising more and eating better. A follow-up questionnaire or interview may therefore have found some significant findings. In the future, a qualitative analysis may reveal more about overweight women in this context. There are also other questions that need to be addressed.

Future Directions

Despite the non-significant findings of the study, questions remain unanswered. With the large effect sizes and close to significant findings in many instances, would a larger sample size result in significant findings? Were the participants' cognitions altered by the fact that they were exercising in a lab (controlled setting) versus an exercise facility or outside (in an uncontrolled setting)? Furthermore, would a follow-up questionnaire, weeks, or months following the completion of the study alter cognitions? Would other modalities, such as walking for a similar duration and intensity produce different or similar results? Would a qualitative analysis result give more information into what was happening in the different EA groups? If the research was grounded more theoretically, would a better understanding be gained of overweight women in this study? Further research is therefore needed to answer these questions. Replication studies are also needed in a similar sample as well as more diverse samples including sedentary individuals, active participants, women with a BMI less than 26, obese women with a BMI greater than 30, and men.

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APPENDIX A

Telephone Interview

SUBJECT'S NAME:____________________________
DATE:____________PHONE NUMBER: (H) ____________
(W)_____________
1st APPOINTMENT DATE:___________:TIME:___________
E-MAIL:_______________________

Subject Eligibility Criteria Checklist

YES (please checkmark if questionable/uncertain)

Chronological age 18-39 yrs. (Birth Date:____________ Age:______)
Gynecological age (yrs. since onset of menses) >6yrs (Age at menarche:__
Regular menstrual cycles: 24-35 day intervals; 9-13 menses per year
(Length of cycle:_____; Number per year:______; Date of "Day 1":____)
(Comments:_______________)
Free from injury (If no, what is the injury?)
No reported history of thyroid disease
No reported history of an eating disorder
Non-diabetic
Free from use of medications and over-the-counter medications (within the last 3 months) which are known to influence hormonal status (e.g. oral contraceptives)
(If not sure, what is the medication?__________________________________)
Non-smoker
No change in body weight in the last 2 months (± 3kg = ± 6.6 lbs)
Amount of change?_____________ (Wt:______ Ht:______ BMI (kg/m^2:______)
No involvement in strenuous physical activities during the 3-days of exercise
(If involved, what are the activities?__________________________________)

Signature of who took call:____

APPENDIX A CONTINUED

OUTLINE OF TELEPHONE CALL

THE BIG PICTURE:

Many women who struggle with weight control have at some point attempted to lose weight by either increasing their activity level or restricting their caloric intake or both. This often produces a deficit in available energy which may lead to increasing difficulty with weight control. It is our goal to be able to identify appropriate levels of exercise and dietary intake that will avoid this metabolic response. In addition we will be looking at the thoughts and feelings that accompany this protocol. With this information a women could receive practical nutritional and exercise prescription guidelines to prevent metabolic stresses the body experiences while deprived of adequate energy.

BEFORE ACQUIRING CRITERIA:

This research study involves several entry criteria and involves a fairly large time commitment on your part. If you do meet the entry criteria, you will have the opportunity to take part in this study. The study will begin on the 1st through 6th day of your menstrual cycle and involves 7 consecutive days of coming to our lab at the University of Alberta in the Faculty of Physical Education & Recreation. The first 6 days involves arriving at our lab between the hours of 6:30am and 9:30am where both a blood and a urine sample will be taken. On days 3,4 and 5 of the experiment, you will exercise for approximately 4 hours in our lab on a stationary bike. This exercise will be performed in 30 minute bouts with 10 minutes of rest. Furthermore, during the 3 days of your exercise, you will only be able to consume a liquid nutritional supplement which we will give you. Brief psychological questionnaires will also be given throughout the 6 days with a final interview on day 7. A final questionnaire administered 4 weeks following your completion of the study.

ENTRY CRITERIA:

3 additional measurements must be completed before participating in the study. These include:

_ 7-day dietary analysis
_ maximal oxygen consumption test (i.e. $VO_{2\,max}$ test)
_ body composition analysis (i.e. Underwater weighing)
  -to be completed in co-ordination with their menstrual cycle

---

NOTES/COMMENTS:

APPENDIX B

PSYCHOLOGICAL QUESTIONNAIRE

Circle the number that best represents how you feel about exercise on each of the scales:

worthless	1	2	3	4	5	6	7	8	9	worthwhile
bad	1	2	3	4	5	6	7	8	9	good
foolish	1	2	3	4	5	6	7	8	9	wise
useless	1	2	3	4	5	6	7	8	9	useful
harmful	1	2	3	4	5	6	7	8	9	beneficial

dull	1	2	3	4	5	6	7	8	9	interesting
aggravating	1	2	3	4	5	6	7	8	9	calming
unpleasant	1	2	3	4	5	6	7	8	9	pleasant
exhausting	1	2	3	4	5	6	7	8	9	invigorating
boring	1	2	3	4	5	6	7	8	9	fun

Self-Efficacy

0% - 10 - 20 - 30 - 40 - 50 - 60 - 70 - 80 - 90 - 100% No confidence Completely confident		Confidence Level
How confident are you that you can exercise when you are:	tired?	
	in a bad mood?	
	feel you don't have time?	
	on vacation?	
	when it is raining or snowing?	
How confident are you that you could:	carry out your activity for the planned duration?	
	pace yourself to avoid over-exertion?	
	perform all the required movements?	
	follow directions from an instructor?	
	check how hard your activity is making you work?	
How confident are you that you could:	exercise two times per week regular for the next three months?	
	exercise three times per week for the next three months?	
	overcome obstacles that prevent you from participating regularly?	
	make up times you missed?	
	exercise regularly, no matter what?	

APPENDIX B CONTINUED

PSYCHOLOGICAL QUESTIONNAIRE

Exercise Outcomes

1	2	3	4	5	6	7	8	9	10
Not at all likely									Very Likely
1	2	3	4	5	6	7	8	9	10
Not at all desirable									Very Desirable

1. **During exercise,** how LIKELY and DESIRABLE do you think it is that you would:	get sweaty		
	increase your heart rate		
	increase your breathing/breathe harder		
	feel exhilarated		
	feel exhausted		
	feel satisfied		
2. **Immediately after exercise,** how LIKELY and DESIRABLE do you think it is that you would:	feel more alert/awake		
	feel more tired and worn out		
	feel refreshed and alive		
	feel satisfied		
	feel more relaxed		
	feel less stressed and anxious		
3. **One or two days after exercise,** how LIKELY/DESIRABLE do you think it is that you would:	feel good physically		
	feel generally happier/feel better emotionally		
	feel stiff/sore/body		
	feel better about yourself/more confident		
	have more energy		
	be more tired		
	feel less stressed and anxious		
	feel satisfied		

APPENDIX C

STRUGGLE WITH WEIGHT CONTROL?
HISTORY OF DIETING?

Researchers at the U of A are examining the effects of exercise and calorie intake on metabolism, thoughts and feelings in women. You qualify for this study if you answer "yes" to the following criteria:

_ 18 - 39 years of age
_ No oral contraceptive pill use
_ 24 to 35 day menstrual cycles
_ BMI ≥ 26

Benefits to You....

- ➔**Aerobic fitness assessment**
- ➔**Body composition, learn about your fat free and fat mass**
- ➔**Dietary analysis**
- ➔**Feedback of results**

☞TOTAL TIME COMMITMENT WILL BE APROXIMATELY 30 HOURS

IF YOU ARE INTERESTED IN FURTHER INFORMATION, PLEASE CONTACT:
LANA ASUCHAK
WOMEN'S HEALTH & PHYSICAL ACTIVITY LABORATORY
FACULTY OF PHYSICAL EDUCATION & RECREATION
492-8739 OR lasuchak@gpu.srv.ualberta.ca

UNIVERSITY OF ALBERTA
FACULTY OF PHYSICAL EDUCATION AND RECREATION

Psychosocial correlates and energy availability in overweight women: implications for dietary and exercise strategies for weight reduction

INVESTIGATORS: Lana Asuchak and Dr. Vicki Harber

APPENDIX D

SUBJECT CONSENT FORM

This study has been satisfactorily explained to me by Lana Asuchak or Dr. Vicki Harber or their designate. I understand the necessity for the protocol outlined in the Study Information Sheet. I know that I may contact the persons designated on this form at any time if I have any further questions. I have been informed of the possible benefits of joining this research study as well as the possible risks and discomforts. I have been assured that the information obtained from my participation in this study may be published in medical reports, but that my personal records will be kept confidential. I understand that an interview will be conducted and all information will be recorded on tapes. All tapes will be destroyed after the recordings have been transcribed. I understand that I am free to withdraw from this study at any time without prejudice. I understand that I will be promptly informed of any findings, which may develop during the research period that may affect my willingness to continue participating in the study. I understand that I will be given a copy of the Study Information Sheet and the signed Consent Form to keep.

Subject Name (print)	Subject Signature & Date
Witness Name (print)	Witness Signature & Date
Investigator Name (print)	Investigator Signature & Date

Questions or concerns may be directed to
Dr. Vicki Harber @ 492-1023 (E-mail:vharber@per.ualberta.ca) or
Lana Asuchak @ 492-8739 (E-mail:lasuchak@gpu.srv.ualberta.ca)

APPENDIX E

DEMOGRAPHIC QUESTIONNAIRE

Name:__________________________________ Date:___________________

Address:_________________________________

Telephone:

(Home)______________(Work)_____________

E-mail:__________________________________

Date of Birth______________________________ Age:___________________

Answer the following questions as accurately as possible.
Please ask for clarification where needed.

1. Have you experienced a weight loss or gain (±3 kg = ±6.6 lbs or more) in the last months? YES_____NO

   If yes, specify the amount of weight lost (-) or gained (+)

2. Have you ever been diagnosed with an eating disorder? YES_____NO

3. List any prescribed medication or over-the-counter medication you regularly take:

____

4. Do you have a heart, liver, or renal disease? YES_____NO

5. Do you have diabetes or a thyroid disorder? YES_____NO

6. Do you have any chronic or "nagging" musculoskeletal aches or pains (e.g. Sore knees, weak back)? YES_____NO

   If yes, indicate the location of your ache or pain and describe any related physical limitations.

7. Are you allergic to any drugs, foods or beverages? YES_____NO

   If yes, please list:

8. Do you smoke? YES_____NO

APPENDIX E CONTINUED

MENSTRUAL CYCLE

1. At what age did you have your first menstrual period?

(Years)

2. Have you taken oral contraceptive pills within the last 6 months? YES_____NO
3. Is your menstrual cycle regular (i.e. Every 24-35 days)? YES_____NO

☞"NO" (answer the next 4 questions then go to "Physical Activity" questions).

(I) When was the last time you menstruated?

(ii) How many periods do you usually have in a year?

(Iii) On average, how many days does your period last?

(Iv) What is the longest time you have gone without a period?

☞"YES" (answer the next 4 questions then go to "Physical Activity" questions).

(I) How many periods do you usually have in a year?

(Ii) On average, how many days does your period last?

(Iii) What is the interval of days between your periods? Indicate the number of days between "Day 1" (onset of flow) of a period, and "Day 1" of the next period.

(Iv) When was the last time you menstruated?

If known, please indicate the last three "Day 1's" of your menstrual cycle:

APPENDIX E CONTINUED

PHYSICAL ACTIVITY

1. Are you involved in a regular routine of physical activity? YES_____NO

☞ If "YES"...

(a) Does your routine include **4 OR MORE SESSIONS** a week YES_____NO

☞ How long have you been doing this routine for?

(b) Does your routine **EXCEED 3 HOURS A WEEK?** YES_____ NO

☞ How long have you been doing this routine for?

2. Please list and describe ALL of your physical activities that you are involved in:

ACTIVITY	**DURATION (min/session)**	**FREQUENCY (sessions/week)**	**INTENSITY***
e.g. Running	**20**	**4**	**1 2 3 4 5**
1.			**1 2 3 4 5**
2.			**1 2 3 4 5**
3.			**1 2 3 4 5**
4.			**1 2 3 4 5**
5.			**1 2 3 4 5**
6.			**1 2 3 4 5**

***INTENSITY:**
1 - Not vigorous at all (very light)
2 - Somewhat vigorous (light)
3 - Moderately vigorous (medium)
4 - Vigorous (heavy)
5 - Extremely vigorous (very heavy)

APPENDIX E CONTINUED

SUBJECT AVAILABILITY

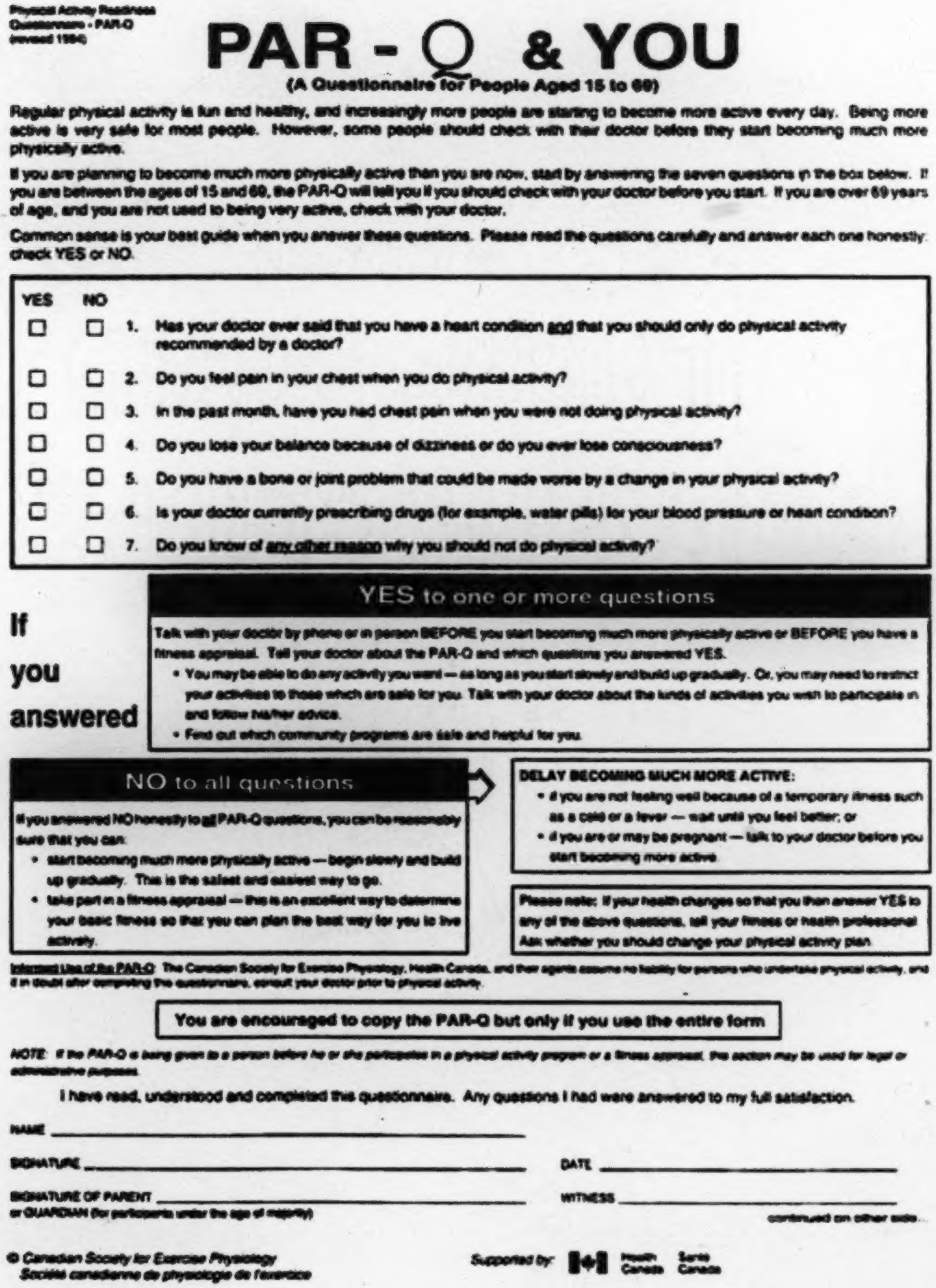
All tests and exercise sessions will be scheduled at your convenience. One test (i.e. body composition) and the 6-day experiment will require co-ordination with your menstrual cycle. Please indicate (with a "_") the times for each day when you are available for testing and exercise sessions.

Time Slot	Mon	Tues	Wed	Thurs	Fri	Sat	Sun
7A.M. - 8A.M.							
8A.M - 9A.M							
9A.M - 10A.M							
10A.M -11A.M							
11A.M – Noon							
Noon - 1P.M.							
1P.M. - 2P.M.							
2P.M. - 3P.M.							
3P.M. - 4P.M.							
4P.M. - 5P.M.							
5P.M. - 6P.M.							
6P.M. - 7P.M.							
7P.M. - 8P.M.							
8P.M. - 9P.M.							
9P.M. - 10P.M.							

Please feel free to add other comments you think are important for us to know:

APPENDIX F

PAR-Q



Physical Activity Readiness
Questionnaire - PAR-Q
(revised 1994)

PAR - Q & YOU

(A Questionnaire for People Aged 15 to 69)

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active.

If you are planning to become much more physically active than you are now, start by answering the seven questions in the box below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and you are not used to being very active, check with your doctor.

Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly: check YES or NO.

YES NO

☐ ☐ 1. Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?

☐ ☐ 2. Do you feel pain in your chest when you do physical activity?

☐ ☐ 3. In the past month, have you had chest pain when you were not doing physical activity?

☐ ☐ 4. Do you lose your balance because of dizziness or do you ever lose consciousness?

☐ ☐ 5. Do you have a bone or joint problem that could be made worse by a change in your physical activity?

☐ ☐ 6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?

☐ ☐ 7. Do you know of any other reason why you should not do physical activity?

If you answered

YES to one or more questions

Talk with your doctor by phone or in person BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered YES.

- You may be able to do any activity you want — as long as you start slowly and build up gradually. Or, you may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.
- Find out which community programs are safe and helpful for you.

NO to all questions

If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:

- start becoming much more physically active — begin slowly and build up gradually. This is the safest and easiest way to go.
- take part in a fitness appraisal — this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively.

DELAY BECOMING MUCH MORE ACTIVE:

- if you are not feeling well because of a temporary illness such as a cold or a fever — wait until you feel better; or
- if you are or may be pregnant — talk to your doctor before you start becoming more active.

Please note: If your health changes so that you then answer YES to any of the above questions, tell your fitness or health professional. Ask whether you should change your physical activity plan.

Informed Use of the PAR-Q: The Canadian Society for Exercise Physiology, Health Canada, and their agents assume no liability for persons who undertake physical activity, and if in doubt after completing the questionnaire, consult your doctor prior to physical activity.

You are encouraged to copy the PAR-Q but only if you use the entire form

NOTE: If the PAR-Q is being given to a person before he or she participates in a physical activity program or a fitness appraisal, this section may be used for legal or administrative purposes.

I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction.

NAME ________________________________

SIGNATURE ________________________________ DATE ____________________

SIGNATURE OF PARENT ________________________ WITNESS ____________________
or GUARDIAN (for participants under the age of majority)

continued on other side...

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Société canadienne de physiologie de l'exercice

Supported by: Health Canada Santé Canada

APPENDIX G

AEROBIC FITNESS TEST

Data Sheet - Monarch Bike

Name: ______________________________ **Group:** _______

Date: _________________ **Age:** _____ **Weight (kg):** ________

TIME (minutes)	RESISTANCE (kg)	REVOLUTIOS (rpm)	HEART RATE (bpm)	COMMENTS
0:00 - 1:00	1.0			
1:00 - 2:00	1.0			
2:00 - 3:00	1.5			
3:00 - 4:00	1.5			
4:00 - 5:00	2.0			
5:00 - 6:00	2.0			
6:00 - 7:00				
7:00 - 8:00				
8:00 - 9:00				
9:00 - 10:00				
10:00–11:00				
11:00-12:00				

TEST RESULTS:

Max HR: ________(bpm)$VO_{2\,max}$: _________ (L/min); _________ ($ml\cdot kg^{-1}\cdot min^{-1}$)

VT: _________ (L/min); _________ ($ml\cdot kg^{-1}\cdot min^{-1}$)VT (% of $VO_{2\,max}$): _______ (%)

HR @ VT: _______ (bpm)Workload @ VT: _______ (kg) RPM's @ VT:______(rpm)

80% of VT: _____ (L/min); _____ ($ml\cdot kg^{-1}\cdot min^{-1}$) 80% of VT (% of $VO_{2\,max}$): ____(%)

APPENDIX H

BODY COMPOSITION ANALYSIS
Data Sheet

Name: ______________________________ **Group:** _______

Date: _____________ **Day of Cycle:** ____________ **Age:** ____

Tester(s): ________________________

Height (cm): _______ **Weight (kg):** _______

HYDROSTATIC WEIGHING		
	PREDICTED (age, height)	**ACTUAL**
RESIDUAL VOLUME (L)		
BODY FAT (%)		
FAT BODY MASS (kg)		
LEAN BODY MASS (kg)		

RESULTS:

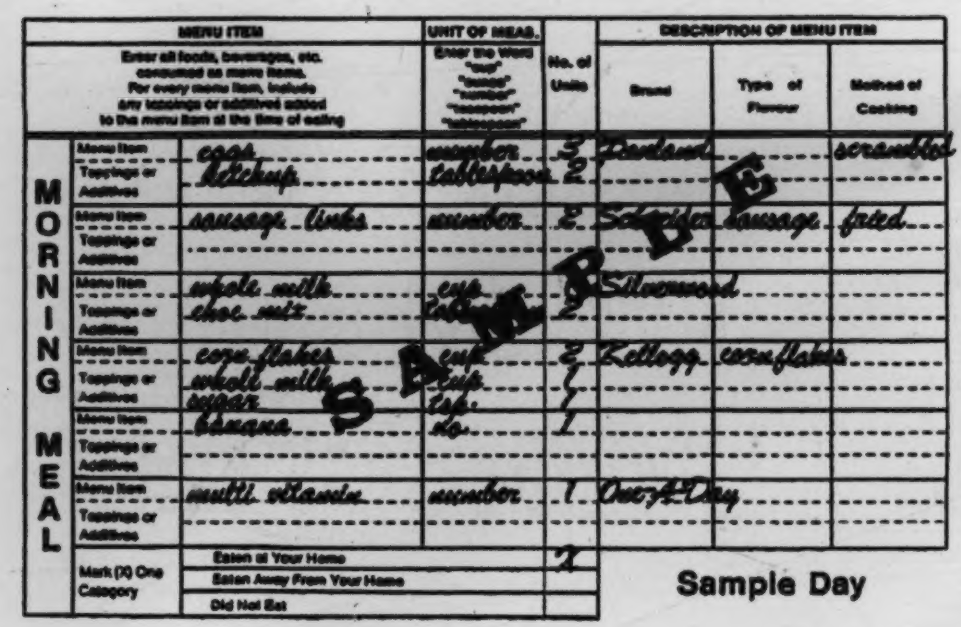
Body Mass Index ($kg \cdot m^{-2}$) (CPAFLA, 1996): ________

Body Fat (%) (Siri, et al., 1963): ____________

Lean Body Mass (kg): _____________

APPENDIX I

7-DAY DIET RECORD



		MENU ITEM	UNIT OF MEAS.		DESCRIPTION OF MENU ITEM		
		Enter all foods, beverages, etc. consumed as menu items. For every menu item, include any toppings or additives added to the menu item at the time of eating	Enter the Word "cup" "ounce" "number" "teaspoon" "tablespoon"	No. of Units	Brand	Type of Flavour	Method of Cooking
MORNING MEAL	Menu Item	eggs	number	3	Dorland		scrambled
	Toppings or Additives	ketchup	tablespoon	2			
	Menu Item	sausage links	number	2	Schneider	sausage	fried
	Toppings or Additives						
	Menu Item	whole milk	cup	1	Silverwood		
	Toppings or Additives	choc mix	tablespoon	2			
	Menu Item	corn flakes	cup	2	Kellogg	cornflakes	
	Toppings or Additives	whole milk sugar	cup tsp.	1 1			
	Menu Item	banana	no.	1			
	Toppings or Additives						
	Menu Item	multi vitamin	number	1	One-A-Day		
	Toppings or Additives						
	Mark (X) One Category	Eaten at Your Home		X			
		Eaten Away From Your Home					
		Did Not Eat					

SAMPLE

Sample Day

APPENDIX J

start time: _______	**6-DAY TREATMENT**	intensity: __________
finish time: _________	**Exercise Data Sheet**	range: ________________

NAME: ________________________ **GROUP:** _______ **Number of Cans:** _____

Workload @ 80% VT: ______ **(kg)** **RPM's @ 80% VT:** ______ **(rpm)**

Duration Required @ 80% VT (min): ______ **(hr:min):** _______

DAY # ___ - DATE: ____________________ Supervisor(s): _______________

“_” (when completed)	Heart Rate / Resistance / Revolutions per minute (every 5 min)	Metabolic Cart Print-Out (minutes 5 through 10)
☐ 1st 30 min of Exercise	5 min:_____ 10 min:_____ 15 min: _____ 20 min:_____ 25 min:_____ 30 min:____	☐
☐ 1st 10 min of Rest		
☐ 2nd 30 min of Exercise	5 min:_____ 10 min:_____ 15 min: _____ 20 min:_____ 25 min:_____ 30 min:____	☐
☐ 2nd 10 min of Rest		
☐ 3rd 30 min of	5 min:_____ 10 min:_____ 15 min: _____ 20 min:_____ 25 min:_____ 30	☐

DAY # ___ - DATE: ____________________ Supervisor(s): ________________

“_” (when completed)	Heart Rate / Resistance / Revolutions per minute (every 5 min)	Metabolic Cart Print-Out (minutes 5 through 10)
Exercise	min:____	
☐ 3rd 10 min of Rest		
☐ 4th 30 min of Exercise	5 min:_____ 10 min:_____ 15 min: _____ 20 min:_____ 25 min:_____ 30 min:____	☐
☐ 4th 10 min of Rest		
☐ 5th 30 min of Exercise	5 min:_____ 10 min:_____ 15 min: _____ 20 min:_____ 25 min:_____ 30 min:____	☐
☐ 5th 10 min of Rest		
☐ 6th 30 min of Exercise	5 min:_____ 10 min:_____ 15 min: _____ 20 min:_____ 25 min:_____ 30 min:____	☐
☐ 6th 10 min of Rest		